

VOL. XXIII., NO. 11

SEPTEMBER, 1930.

PROCEEDINGS
of the
ROYAL SOCIETY OF
MEDICINE



LONGMANS, GREEN & CO^L^D
39, PATERNOSTER ROW, LONDON
NEW YORK · BOMBAY · CALCUTTA · MADRAS

All rights reserved



VACCINES

for Respiratory Infections

PROPHYLACTIC inoculation against the common "cold," influenza and catarrhal conditions of the respiratory tract generally, has given a high degree of immunity in a large number of cases.

¶ The micro-organisms most commonly found in patients suffering from "colds" are Pneumococcus, Pfeiffer's Bacillus, Micrococcus catarrhalis and Bacillus septus and these are included in the **Anti-Catarrh Vaccine** prepared in the Department for Therapeutic Inoculation, St. Mary's Hospital, London, W., especially for the prophylaxis of colds in adults.

A slightly modified formula is supplied under the title **Anti-Catarrh (Public Schools) Vaccine**.

¶ Vaccine treatment of respiratory infections often helps to abort an attack. **Cold Vaccine (Mixed)** is specially prepared for therapeutic use in connexion with common "colds" and bronchitis. It is suitable for routine use, as its composition has been chosen so as to avoid the necessity of a bacteriological examination.

¶ It is generally agreed that the serious and sometimes fatal complications of influenza—such as bronchitis and pneumonia—as well as many of the less severe symptoms, are caused by infection with Pfeiffer's Bacillus, Pneumococcus and Streptococcus. On this account the **Anti-Influenza Vaccine (Mixed)**, *St. Mary's Hospital Formula*, which contains these three organisms is of great value as a prophylactic of influenza.

Further particulars of these and other Vaccines prepared in the Department for Therapeutic Inoculation, St. Mary's Hospital, London, W., will be sent on request.

SOLE AGENTS:

PARKE, DAVIS & COMPANY
50 Beak St., London, W.1.

Inc. U.S.A., Liability Ltd. Laboratories: Hounslow, Middlesex.



Section of Odontology.

[April 28, 1930.]

Periodontal Disease in Dogs (Experimental Gingivitis and "Pyorrhœa").

By MAY MELLANBY.

TO-NIGHT I should like to give you a short account of experiments which throw some light on the ætiology of gingival and periodontal disease ("pyorrhœa"). This work has now extended over many years, but up to the present I have made only passing references to it. The importance of periodontal disease as one of the commonest afflictions of mankind is generally recognized, and this importance is reflected in the many publications of different workers on the ætiology and the pathology of the subject. It is not necessary to remind you of the valuable investigations published by such well-known investigators as Warwick James and J. G. Turner in England, Gottlieb in Austria and Box in Canada. As far as I know, however, none of these investigators has dealt with the aspect of the disease which I propose to describe, namely, the effect of certain dietetic constituents after absorption from the alimentary canal, on the histological structure of the developing periodontal tissues, and the ultimate variations in resistance to disease shown by these tissues. I wish to show, in fact, that it is possible to produce structural variations in the periodontal tissues of dogs by feeding them on different diets during the period of development, and that these variations are of primary importance in the subsequent onset of gingival and periodontal disease. In experiments on puppies it was soon noticed (1920 *Dental Record*) that the soft, as well as the hard dental tissues, varied in character when fat-soluble vitamins in the diet were, on the one hand deficient, and on the other abundant. As most of the histological sections in the earlier experiments were prepared by Weil's process, so as to preserve both the calcified and uncalcified tissues intact, they were usually too thick to allow of a detailed examination of the soft tissues, although these were generally retained *in situ*. More recently, decalcified sections have been prepared from representative regions of the jaws of many dogs, so that a more careful study of the soft tissues has now been made. Defect of the attacking tissues is mentioned by McCollum and Grieves as occurring in a certain percentage of rats whose diets are ill-balanced as regards calcium, phosphorus and fat-soluble vitamins.

The dietetic conditions which control the developmental structure of dental tissues involve, primarily, the fat-soluble vitamins A and D. These vitamins, although at one time thought possibly to be identical, are now known to have different functions. Experiments made both in England and America have shown that an important function of vitamin A is its control of the epithelial tissues, and especially of squamous epithelium; in its absence, hyperplasia, keratinization and even metaplasia of the epithelium have been described. If young animals are fed on a diet complete, except for vitamin A, multiple infective foci are found post-mortem. These infective foci have their origin, as a general rule, in those places where squamous epithelium has hypertrophied. Thus abscesses are often found in

the nasal sinuses, middle ear, base of the tongue, in the pelvis of the kidney and other places. Vitamin A is apparently not specifically a growth vitamin, but rather an anti-infective vitamin [1]. The function of vitamin D is quite different. Its most important action is to control calcification [2]. Thus, in its absence, bone shows either osteoporosis, or is associated with osteoid tissue, or, as in the case of the teeth, hypoplasia and defective calcification result [3].

The first series of slides demonstrates the effect of vitamin D deficiency on the development of alveolar bone (alveolar crest and lamina dura). The bone, instead of being compact, as in the normal, where much vitamin D was included in the diet, is osteoporotic, with much osteoid tissue. The effect of abnormal development of the lamina dura on the varying width of the periodontal membrane is to be noted. Vitamin A, on the other hand, appears to influence the normal development of the soft dental tissues, and especially the stratified epithelium. With a deficiency of this vitamin the gingival regions are swollen, the epithelium is hypertrophied and the corium shows a reaction to this hyperplasia in the form of cell infiltration. With a deficiency of vitamins A and D, the hard and soft tissues are both abnormally developed.

The following table gives the chief differences found in the periodontal tissues in young dogs on diets varying in their vitamin A and D content.

TABLE I

		1			2			3			4	
		Very little of vitamins A and D			Liberal amount of vitamins A and D			Liberal amount of vitamin A, little of D			Little of vitamin A, liberal amount of D	
Alveolar bone	...	Calcification poor. Osteoid tissue		...	Calcification very good		...	Calcification poor		...	Calcification good	
Epithelium:												
Thickness	...	Thick	...	...	Thin	...	...	Thin	...	...	Thick	...
Regularity	...	Irregular	...	"pro-	Regular	...	...	Regular	...	...	Irregular	...
		cesses"										
Corium:												
Thickness	...	Thick	...	...	Thin	...	...	Thin	...	...	Thick	...
Cell infiltration	...	Some	...	...	None	...	...	None	...	...	Slight	...
Periodontal membrane:												
Thickness	...	Thick	...	...	Thin	...	...	Thick	...	...	Thin	...
Regularity	...	Irregular	...	...	Regular	...	...	Irregular	...	...	Regular	...

I will now put before you some of the thirty or more experiments which have lasted for periods varying from three to eight years, and which were designed with the object of testing the effects of certain factors of diet on the development of periodontal disease. They definitely indicate that the developmental structure of the periodontal tissues is of profound significance in their subsequent resistance to disease. There is no need here to give any details of the experimental methods, except to say that the mouths of the animals were examined twice a year and radiographs were taken periodically. After death, ground and decalcified sections of many regions were prepared. In the first place I must refer to the fact that it is possible to keep dogs in a laboratory for at least eight years without any definite periodontal disease developing in spite of a soft pappy diet and but little opportunity for general and local exercise. The hard and soft dental tissues of one animal (number 5), for instance, were all normal or almost normal when it was killed after eight years' experiment. The diet for the first year included liberal amounts of vitamins A and D, but after this period for four of the last seven years the vitamins were deficient and the animal ate large quantities of oatmeal.

The comparative effect of diets deficient and abundant, respectively, in vitamins A and D from the time of weaning to the age of seven years is illustrated in the following experiment: Two puppies (numbers 6 and 7) of the same litter were given

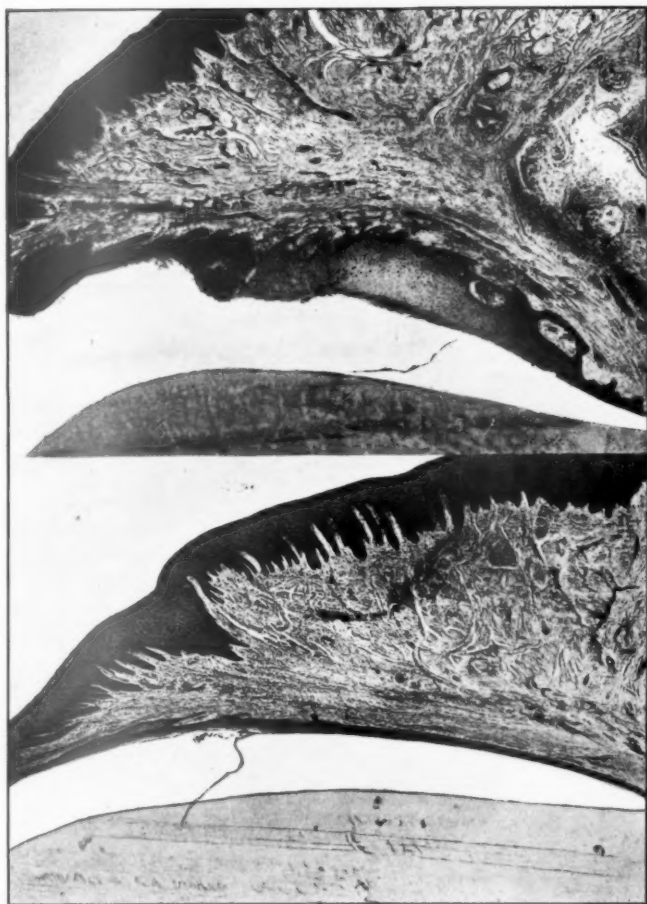


FIG. 1.

FIGS. 1 AND 2.—PHOTOMICROGRAPHS ($\times 40$) OF THE GINGIVAL REGIONS OF TWO YOUNG DOGS.
(THE ENAMEL HAS BEEN REMOVED.)

FIG. 1.—Liberal amount of vitamins A and D included in diet. Corium thin, and subgingival epithelium thin and regular.

FIG. 2.—Little vitamins A and D included in diet. Corium thick, and subgingival epithelium thick and irregular, with some "processes." Some cell infiltration in the connective tissue.

the same basal diet including bread, but one animal (6) had a liberal supply of fat-soluble vitamins A and D, whereas the other (7) had little. In the latter, as seen in the lantern slides, disease both of the soft tissues and of the alveolar bone developed, gradually at first but later more rapidly. Some teeth have been shed and pus is present in the pockets surrounding many of the remaining teeth. In puppy 6 little or no pathological change is seen, either clinically or by means of radiographs. A summary of this experiment is tabulated below.

TABLE II.

Animal 6	Animal 7.
<i>Diet from age of 6 weeks to 7½ years.</i>	
Abundant in vitamins A and D. Good structure of teeth after eruption.	Deficient in vitamins A and D. Poor structure of teeth after eruption.
<i>Condition of mouth at age of 7½ years.</i>	
Mouth clean.	Mouth "dirty."
Breath good.	Breath foul.
Gums nearly normal.	Some recession of gums.
No pockets; no pus.	Many deep pockets; pus.
Very little tartar.	Much tartar.
Very little bone absorption.	Much bone absorption.

No microscopical differences can be given as the animals are still alive.

Further slides show the effect of a deficiency of vitamins A and D during the first few months of life only. For instance, two puppies (8 and 9) of the same litter were given a basal diet, including oatmeal, for seven years. Puppy 8 had, in addition, 3 c.c. of cod-liver oil throughout the whole period, whereas puppy 9 received olive oil for the first four months of the experiment and later had 10 c.c. of cod-liver oil. In spite of over six and a half years' feeding on cod-liver oil, periodontal disease developed in animal 9, but not to as extreme a degree as in the previous experiment (animal 7), in which the vitamins A and D were deficient throughout life. Animal 8 remained free from disease, as shown in the following table:

TABLE III.

Animal 8.	Animal 9.
<i>Diet from age of 2 to 5 months.</i>	
Moderate amount of vitamins A and D. Structure of teeth after eruption good.	Deficient in vitamins A and D. Structure of teeth after eruption very poor.
<i>Diet from age of 5 months to 6½ years.</i>	
No change.	Abundant in vitamins A and D.
<i>Condition of mouth at age of 6½ years.</i>	
Mouth clean.	Mouth "dirty."
Slight pockets round one or two teeth; no pus.	Pockets in many regions.
Little tartar.	Some tartar on all teeth.
No bone absorption.	Much bone absorption.

This experiment and others of a similar nature strongly suggest that it is during the developmental period that a good supply of vitamins A and D is essential for the perfect formation of the tissues.

The effect of giving the same quantity of vitamins A and D to two animals, but at different times, is demonstrated in the following experiment: One animal, number 11, had a deficiency of vitamins A and D during the first few months



FIG. 3.

FIG. 4.

FIGS. 3 AND 4.—PHOTOMICROGRAPHS ($\times 40$) OF THE GINGIVAL REGIONS OF THE TWO DOGS, 10 AND 11, THREE YEARS OLD AT DEATH.

FIG. 3. DOG 10.—Liberal amount of vitamins A and D during development, little later. The tissues have remained nearly normal.

FIG. 4. DOG 11.—Little vitamins A and D during development, liberal amount during second period, and little supply during third period. The subgingival epithelium is very hyperplastic and there is much cell infiltration in the connective tissue. Abscess developing. Tartar present in sulcus.

after weaning; later, for a similar period, a liberal supply of A and D was given, and for the last two and a half years of the animal's life, the vitamins were again reduced. The other animal, number 10, was fed on a diet abundant in these vitamins for the first period after weaning, but from then until it was killed, its diet was defective. Advanced periodontal disease was present in animal 11, but there were only early signs of it in animal 10, as shown below.

TABLE IV.

<i>Animal 10.</i>		<i>Animal 11.</i>	
Diet.		Diet.	
1st period:	abundant in A and D.	1st period:	deficient in A and D.
2nd "	deficient " "	2nd "	abundant " "
3rd "	deficient " "	3rd "	deficient " "
<i>Condition at death.</i>			
Very little recession of gum.		Recession of gum.	
Indication of slight pocket.		Several deep pockets.	
No bone-absorption in lower jaw, a little in upper jaw.		Large amount of bone-absorption in upper and lower jaws.	
Epithelium very little thickened and slightly irregular.		Epithelium much thickened and irregular.	
Little connective-tissue reaction.		Much connective-tissue reaction. Abscesses in some regions.	

In these experiments also it appears that the early administration of vitamins A and D ensured proper development of the soft and calcified tissues and thus increased their resistance to periodontal disease.

Conclusions and Summary.

- (1) Periodontal disease can be produced and prevented under experimental conditions in dogs.
- (2) Deficiencies of vitamins A and D in the diet are very important factors in the development of the soft and hard periodontal tissues.
- (3) Vitamin A deficiency is largely responsible for the overgrowth and abnormality of the periodontal epithelium and the corium.
- (4) Vitamin D deficiency is responsible for defects in the hard periodontal tissues (alveolar bone, lamina dura, etc.).
- (5) The developmental variations during the period of growth are of the utmost importance in resistance of the tissues to disease. A deficiency of vitamin A and D during early life is of much greater significance than the same deficiency after the periodontal tissues are developed. Thus a defective diet during growth followed by a complete diet in maturity is more likely to lead to periodontal disease than a complete diet during development and a defective one during maturity. This may account for a condition often seen in man, namely, the presence of periodontal abnormalities in a mouth where there is little or no caries, a condition which would be explained by the consumption of a diet poor in fat-soluble vitamin A but rich in D during development and eruption of the permanent teeth, but containing a liberal supply of both vitamins in later life. I have shown [4] that the addition of fat-soluble vitamin D to a diet will check the onset of dental caries even when the structure of the teeth is poor.
- (6) Injury, tartar and dirt have been regarded by many investigators as being of ætiological significance in periodontal disease, although others contradict this. In these experiments—(a) injury to the gingival margin tends to induce local periodontal disease; (b) where tartar and dirt accumulate, periodontal disease is

usually more emphasized, but which is cause and which is effect it is impossible to say. Both tartar and periodontal disease are possibly produced by the same dietetic defects.

(7) The fact that two dietetic deficiencies may be concerned in the aetiology of this disease, namely, the deficiencies of vitamins A and D, seems to throw light on one of the controversies as to whether the pathological changes of the soft tissues precede the bony changes or *vice versa*. It is probable that either may occur first on the above hypothesis, although, as a practical fact of dietetics in England, a deficiency of A usually involves also a deficiency of D and *vice versa*. Experiments are now in progress with the object of differentiating further between vitamins A and D in the aetiology of the different forms of periodontal disease.

(8) Although I have not emphasized the part played by cereals, the evidence available suggests that they antagonize both vitamins A and D.

REFERENCES.

- [1] GREEN, H. N., and MELLANBY, E., *Brit. Med. Journ.*, 1928 (ii), 691.
- [2] MELLANBY, E., (a) *J. Physiol.*, 1918, *Proceedings*, Jan. 26 and Dec. 14. (b) *Lancet*, 1919 (i), 407.
- (c) *Medical Research Council, Special Reports Series*, No. 61, 1921.
- [3] MELLANBY, MAY, (a) *Lancet*, 1918 (ii), 767. (b) *Dent. Record*, 1920, 40, 63. (c) *Medical Research Council, Special Reports Series*, No. 140, 1929.
- [4] (a) MELLANBY, PATTISON and PROUD, *Brit. Med. Journ.*, 1924 (ii), 354. (b) MELLANBY and PATTISON, *Brit. Dent. Journ.*, 1926, xlvii, 1045. (c) MELLANBY and PATTISON, *Brit. Med. Journ.*, 1928 (ii), 1079.

Discussion.—Mrs. MELLANBY said that she and her husband had had an opportunity of examining in Johannesburg, during the previous year, the mouths of large numbers of natives collected from various centres for distribution to mines, etc. There they found disease of the gums fairly common but decay was comparatively rare except in a few of the more degenerate tribes. In Rhodesia and Kenya there had also been an opportunity of examining the teeth of adults and children. In the mission schools there seemed to be more caries than was found in the children running about freely in the sunshine. On the other hand, there was often very little caries in the teeth of the older students who had lived in the sunshine during their early years. Dogs did not get caries, at any rate readily, but, on the other hand, they, and especially pet dogs, suffered from periodontal disease. She was persevering with the question of caries in dogs and also in other animals. The breast-feeding of children, of course, was a most important problem, as was the diet of the mother during pregnancy and lactation. It was equally important that after weaning, the diet should be very carefully considered, for during those early years of rapid growth there was great need of the right substance in the food.

Dr. J. KINGSTON BARTON, referring to the slides exhibited, said that special interest attached to those showing animals which had been fed for the first five months on a good diet, passed on to a bad diet, and then again fed on a good diet. Those cases had strongly demonstrated the effect of proper diet from the beginning in the resistance to infective conditions. In children it was a curious thing that it was the milk teeth that led to various diseases. It was to be hoped that Mrs. Mellanby was working in that direction, because apparently the animals that had lived had suffered from pyorrhœa rather than from defects in the dental structure. His own experience had always been that in the case of a child from 12 to 16 years of age with really good teeth, the assertion could safely be made that the child had been fed at the breast. If the animals—and consequently the children—were fed on the proper diets in the first few months of life and up to the time of weaning, they could afford to go through long periods on false diets.

Dr. H. S. STANNUS, with regard to the observations on teeth made in Africa, said that pyorrhœa existed in many tribes to the extent of 100%, though in some cases not 1% showed the presence of caries. Although the native children were fed at the breast for two years, they were literally stuffed with carbohydrate, and all suffered from carbohydrate dyspepsia from early life. There appeared to be a deficiency of vitamin A and an abundance of vitamin D, and the circumstances seemed to afford an interesting example of the natural separation of vitamins A and D. He wondered if the diet given to the animals referred to by Mrs.

Mellanby had been varied in any other way than by changing the vitamins? He was quite convinced that in certain of the deficiency diseases the absence of a vitamin was by no means the sole cause of the process; it was one factor only. Further work on that subject was necessary.

Mr. J. G. TURNER said that Mrs. Mellanby had demonstrated what a large and persistent amount of work had to be done in order to acquire any knowledge of the causes of disease. Further, she had demonstrated the difficulty of interpretation of the data obtained. It was known that the best-fed children and the best-fed animals, when once confronted with sticky food, would contract pyorrhœa, a fact which seemed to him difficult to correlate with Mrs. Mellanby's work. Granted that one of the vitamins had produced bad teeth, what was really the beginning of the trouble in the mouth? It was possible that all the rest was due to germ action locally. The epithelial proliferation was common to all inflammatory troubles in the mouth, as elsewhere, beginning on the surface. That proliferation produced a stagnation area, and the germs had a further chance of multiplying and of causing further infection. And so we came back to the conclusion that pyorrhœa was very nearly incurable.

Section of Laryngology.

[Summer Meeting, June 20, 1930, continued.]

Thirty Foreign Bodies Removed from the Air and Food Passages.

By D. A. CROW, M.B., Ch.B.

OF the first foreign body case in which I performed œsophagoscopy I have no record. It is nevertheless deeply engraved upon my memory by reason of its tragic termination. A colleague who had unsuccessfully endeavoured to remove a jagged half tooth-plate from a woman's post-cricoid œsophagus asked me if I would care to try. Nothing looks difficult to the inexperienced and I set about the task with a high confidence. In order to rotate the foreign body I introduced a steel hook. I think back on that moment with horror; the hook stuck and could in no wise be removed. By œsophagotomy the plate, but not the hook, was recovered. The patient died. So heavily did this event weigh upon my mind that I would not touch an œsophagoscope till I had been over to Philadelphia and closely studied Professor Chevalier Jackson's methods, and much as I could say—and should like to say—in admiration of the man himself and of his mechanical genius, the fact that I have never since unsuccessfully tackled a foreign body case is the simplest and most sincere tribute I can imagine.

Cases i to ix.—The next few cases were of coins all impacted below the crico-pharyngeal band; they do not present any unusual points of interest. Provided that we can get such cases early, that the issue has not been prejudiced by blundering attempts at removal, and that the operator is mindful of the tendency of coins to hide under the crico-pharyngeal fold, these foreign bodies cause the least anxiety of any.

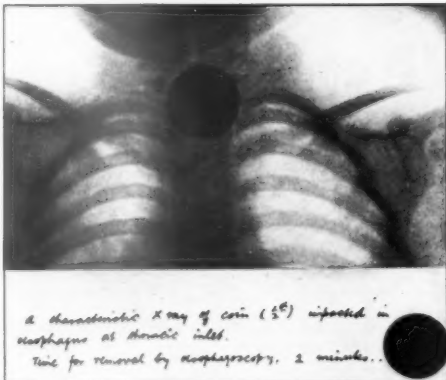


FIG. 1.—Case i.

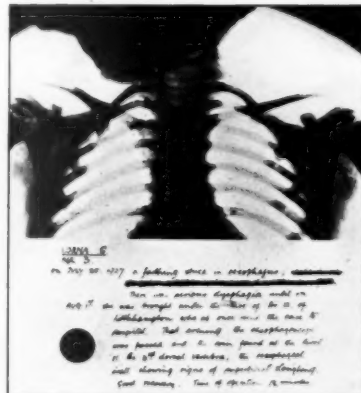


FIG. 2.—Case ii.

Case ii.—The child in this instance was allowed to go untreated for a week, hardly able to swallow anything; there was a certain amount of sloughing of the œsophageal wall.

Case iii.—Presents no unusual feature.

Cases iv, v, vi, vii, viii, ix.—Six coins, almost all of them dealt with soon after impaction and, therefore, without difficulty.

Case x.—Here is a brass object from a whistle, similar to a coin, from the endoscopist's point of view.

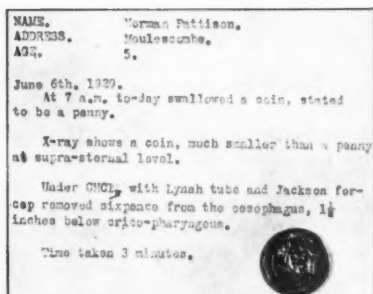


FIG. 3.—Case iii.

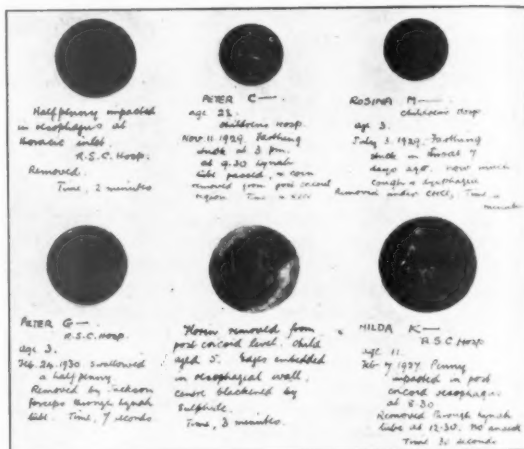


FIG. 4.—Cases iv, v, vi, vii, viii, ix.



FIG. 5.—Case x.

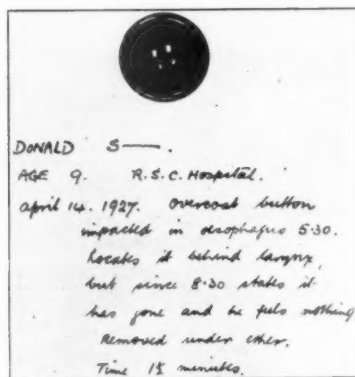


FIG. 6.—Case xi.

Case xi.—An overcoat button in the oesophagus. The child nearly deceived me by stoutly maintaining that the button had gone down.

Cases xii and xiii.—Two bones from the oesophagus. A general anaesthetic has been used in almost all of the cases. It is by no means impossible to effect the removal of them under local anaesthesia but I prefer to avoid the psychological trauma which such a procedure involves.

sense to realize that absence of symptoms is quite compatible with the presence of a non-obstructing bronchial foreign body. He sent the child to hospital for an X-ray examination, and within five days I therefore had the opportunity of removing the foreign body by means of the 4-mm. bronchoscope. The safety catch required a little disimpaction from the upper bronchus opening and had to be steered rather carefully through the larynx.

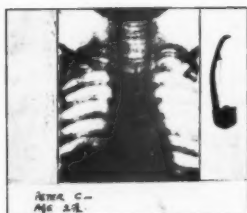


FIG. 11.—Case xxi.

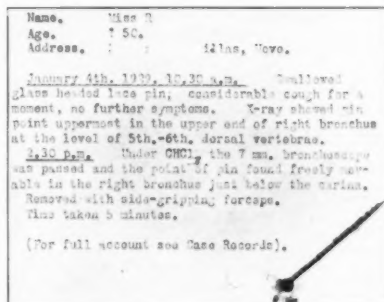


FIG. 12.—Case xxii.

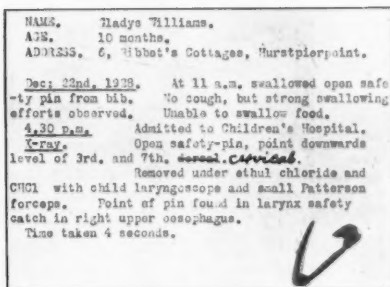


FIG. 13.—Case xxiii.



FIG. 14.—Case xxiii.

Case xxii.—This patient inhaled into the bronchus a glass-headed shawl pin.

Case xxiii.—A safety-pin in a child's hypopharynx.

Case xxiv.—This is half an upper denture removed without difficulty from the post-ericoid oesophagus.

Cases xxv and xxvi.—Two dental plates, both swallowed when the patient gasped with the initial plunge while sea bathing. The larger one required a little careful disimpaction, the smaller one presented no difficulty.

Case xxvii.—A whole denture swallowed by a feeble-minded woman; the hypopharynx seemed quite without sensation.

Case xxviii.—So far the cases shown have been of recently impacted foreign bodies, thanks to the alertness of my colleagues and house surgeons. Here, however, is a case of a boy aged 19, who for eleven years had a pencil cap in his lung. It had



FIG. 15.—Case xxiv.



FIG. 17.—Case xxvii.

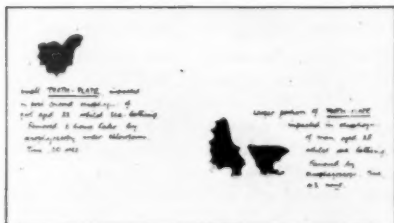


FIG. 16.—Cases xxv and xxvi.

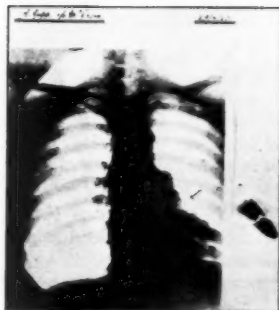


FIG. 18.—Case xxviii.

caused a lung abscess which, some years previously, had burst into the pleural cavity and required rib resection; his condition when I first saw him was deplorable, and there was nothing to make one hopeful that he would survive. He was emaciated, his fingers were clubbed, there was constant expectoration of foul-smelling pus, and he was quite unable to work. I cannot claim this as a triumph for bronchoscopy.

On two occasions I spent half an hour trying to get through the stricture in the bronchus, by the aid of a specially heavy, stiff spring forceps which Professor Jackson sent me for the purpose; not only did I fail to see or bring up the foreign body, but I was troubled to find that my manipulations set up a considerable hæmoptysis within the next few hours. I had the melancholy suspicion that I was killing the patient. Next day, however, the bleeding ceased and a further skiagram showed the pencil cap displaced downwards and outwards some three inches towards the periphery of the lung. I asked for assistance from a general surgeon, Mr. J. R. Griffith, who, on the second attempt, recovered the foreign body by external operation. As a result of his skill, a complete recovery resulted; in six months the patient was able to work, and he is now happily employed as a steward on the "Aquitania."

Case xxix.—A woman inhaled the heavily filled, natural crown of a molar tooth during gas extraction. On waking up, she coughed for a few minutes and then felt nothing much unusual, except a slight awareness of something deep in the chest. The dental surgeon with commendable frankness urged the patient to have an X-ray examination in case the tooth had gone into the lung. Such was the case; it lay deep in the left lower bronchus, and physical examination showed no air entry into most of the lower lobe. Next day, the 7-mm. bronchoscope was introduced, the tooth located with difficulty, tucked away in one of the larger terminal branches, and removed by Jackson's side-grasping forceps. Both the patient and the dentist made a rapid recovery.

I believe it to be our concern as bronchoscopists to implore the dental surgeons to take far more precautions than many of them do, with regard to teeth slipping down the throat. It is the dental surgeon's only opportunity of killing his patient; we are entitled to ask for *absolute* precautions in respect of the danger. In my opinion, no tooth should be extracted in a frantic hurry and a large gauze swab should always be placed behind the site of operation.

If they are unwilling to observe these simple precautions and a tooth goes down the throat, the dentist does not keep faith with his patient if he preserves silence and omits to have a skiagram taken. In a court of law, I imagine, it would not be the accident which would be stressed, but whether or not immediate steps were taken to recover the tooth. I do not see how any dental surgeon dare neglect radiography and bronchoscopy in such circumstances.

Case xxx.—The last case of the series was the most dramatic of any in my experience. A doctor rang me up and said that during a tonsil dissection the previous day in a girl aged 13, he had been alarmed by a sudden respiratory embarrassment, the patient becoming deeply cyanosed and obviously in serious danger. He had been up all night giving her oxygen, believing that the trouble must be due to an unusual amount of blood inhaled or to a sudden cardiac failure. When he spoke to me on the telephone, however, he asked me if I thought it possible that a swab had gone down. I said I would come over at once, prepared for a bronchoscopy. He did not think I should be in time, so perilous was the situation; and when I arrived, the child was certainly conscious, but grey in the face and the pulse was almost imperceptible. No air entered the lung at all.

There was nothing wanting to make the decision as critical and anxious as one could imagine. The doctor could not persuade himself that a swab was in the lung. If I gave an anæsthetic and the child merely had an acute heart failure, the issue would be fatal and I could but admit an awful blunder. If the swab were present, and the anæsthetic proved fatal, the inquest would have been a distressing affair for the doctor. Yet an anæsthetic had to be given, for without it the risk from straining, coughing and fright would have been far greater.

I acknowledge gratefully the cool courage of my anæsthetist, Dr. Eccles. He induced with ethyl chloride and continued with chloroform; in less than three

minutes this swab, already foul-smelling, was found tightly corking the left bronchus, and was easily removed, so that in two or three days' time the child was again quite well.

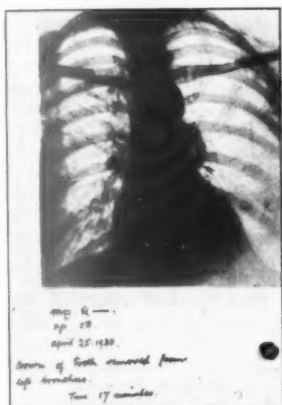


FIG. 19.—Case xxix.

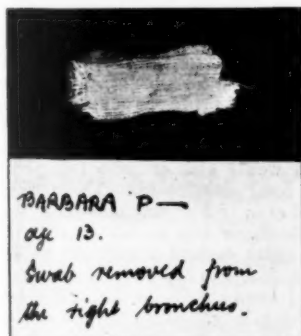


FIG. 20.—Case xxx.

These cases which I have presented took six years to collect. That in itself justifies their being brought forward, because it means that this kind of work is uncommonly met with, and, therefore, the sharing of experience must make up for our individual lack of opportunity.

Moreover, publication will emphasize to our colleagues in practice the fact that precise methods of dealing with these emergencies are available; they already suspect that rough and blind methods have little to commend them; it is for us to show that our claim to precision rests upon a steady basis of fact.

Discussion.—The PRESIDENT said that the fatal case raised an important point as to the limitations of the method of attempting to remove foreign bodies from the œsophagus by the direct route; there were cases in which attempts by the direct method could not succeed, and he did not know whether all operators had clearly formulated in their minds what the prohibitory conditions were. If the foreign body was a large one and had been *in situ* for a considerable time, and if there were physical signs of rupture of the œsophagus, the direct method should not be attempted; the case should at once be dealt with by external operation. He had seen cases in which there was emphysema in the neck, owing to rupture of the œsophagus. To attempt the direct method in such a case was to lose time and to make the patient worse, as there was a great danger of sepsis. Further, in operating on such cases one should limit as much as possible the opening in the deeper planes of the neck, particularly towards the lower part.

Mr. T. B. LAYTON said he was in general agreement with Dr. Crow, but wished to criticize three phrases that he had used. First, he had spoken of "blundering attempts at removal" in reference to the coin cases. From this he (the speaker) inferred that Dr. Crow alluded to the removal of coins with the coin-catcher, and he (Mr. Layton) denied that to remove a coin with the coin-catcher was a "blundering method." It was a right and proper method. In Dr. Crow's list of thirty foreign bodies, nine were coins. In his (Mr. Layton's) clinic these nine coins would have been removed by him, or rather by his dresser, with the coin-catcher. This would have been done in 5 seconds as against from 1½ to 4 minutes, and chloroform would have been avoided in every case. It might be asked whether he had ever had any anxiety with the coin-catcher? The answer was "Yes, once!" but the experience had taught him how to avoid any such anxiety in the future. The coin had become stuck

against the lower margin of the cricoid; this had happened because he had used a coin-catcher with a wide immobile angle. This accident would not happen if one used a coin-catcher with a narrow angle and a mobile end, so that the coin would be caught in either side. In the case mentioned he had disengaged the coin-catcher and arranged to carry out endoscopy next day, by which time the coin was in the child's cæcum. This case had explained to him the only bad result due to the use of the coin-catcher in the cases recounted by Dr. Irwin Moore.¹ In all the other cases recounted in Dr. Irwin Moore's paper the ill-effects were due not to the use, but to the abuse, of this instrument. Because certain persons did not employ a proper technique and did not take due precautions was no reason for decriing any instrument. He would remind Members that "blundering attempts" might also be made with an endoscope. Of the two fatal foreign bodies cases in his clinic during the last eleven years, one was due to this cause. In the case of an infant with an open pin in the œsophagus, not only had the foreign body been driven down into the stomach, but its point had also been driven into the liver. The child was sent up in an ambulance and kept alive on the journey by a cylinder of oxygen. After a rest, the pin had been removed by laparotomy, but the infant died from peritonitis.

He would also criticize the phrase "psychological trauma" as applied to procedures under local anaesthesia. There was no psychological trauma when these were properly carried out; if that was present it meant that the surgeon did not know how to obtain the anaesthesia, or was unable to control the patient. He (the speaker) operated on these cases under general anaesthesia as Dr. Crow did, but he admitted that he did so because he was unable to apply the local anaesthetic and to control the patient. In one such case he had been able to do this, and it had shown the advantage of the method, for the patient, an elderly lady, had an abscess of the pharynx, caused by a fishbone, and this lay immediately behind the arytenoid in such a position that, had it burst while the coughing reflex was abolished, the pus would probably have gone down into the lungs.

The third remark that he criticized was that which implied that the only risk in dental surgery was that of a tooth entering the lung. A second risk was sepsis, and the administration of an anaesthetic was a third.

It was said that one learnt more from failures than from successful cases, and he would remind Members that in a case of a foreign body in the œsophagus, the symptoms might be entirely respiratory. He had been called to a case in a small child in which there was no history of foreign body, but after the provisional diagnosis of laryngeal diphtheria had been excluded it had been suggested that a foreign body might be present. He had passed a bronchoscope and found nothing. The child had subsequently died, and a large bone stud was found post-mortem in the œsophagus. That life could easily have been saved had he either passed a tube down the œsophagus, as well as the bronchus, or had a skiagram taken.

Dr. J. S. FRASER said that he personally did not like the coin-catcher, though he knew it was sometimes used in the surgical out-patient department, where the house surgeon "had a shot" at removing a coin before sending the case to the ear-and-throat department. In at least one case the result had been disastrous. He could not see why the use of the coin-catcher should be preferred to endoscopy; it was much safer to remove a coin when it could be seen than when it was being groped for.

The President had well said that if there was evidence of cellulitis in the neck, the endoscope should not be used; he (the speaker) would go further and say that if one had been trying for a reasonable time and had failed to remove a tooth-plate with the endoscope, it was better to perform an external operation. In these cases of impacted tooth-plate he recommended a general anaesthetic. In other cases, e.g., those of coins, buttons, etc., he always used a local anaesthetic.

Mr. MUSGRAVE WOODMAN said that in 50% of the cases in which the coin-catcher was used, the coin was pushed into the stomach, in which case gastrotomy might be required to remove it. He found it very difficult to cut tooth-plates in half *in situ* so as to remove them from the œsophagus. He agreed with Dr. Fraser that when there was perforation or laceration of the œsophageal wall, removal should be carried out by an external incision. His own practice was, if possible, to remove embedded tooth-plates *per vias naturales*. But if there was even a suspicion of perforation or laceration of the œsophagus, an external incision was made, maintaining drainage externally for the following week. No case had been lost at his hospital since this practice was adopted, but patients were lost when it had been omitted, owing to infection having occurred in the neck.

¹ *Lancet*, 1919 (ii), 566.

Mr. HAROLD KISCH said that the coin-catcher had a definite use, and all students should be taught how to employ it, as they might be practising beyond the reach of any endoscopist or œsophagoscopist. If every practitioner were required to be able to pass bronchoscopes and œsophagoscopes, the mortality would be higher than that following the proper use of the coin-catcher. In the East, during the late war, he (Mr. Kisch) had removed many foreign bodies, such as coins, pieces of bully-beef tins, etc., and in some cases the men had been sent hundreds of miles because medical officers had not been taught how to use the coin-catcher, or remove foreign bodies with the probang. He had either to put a coin-catcher down or a catheter with gauze tucked on the end of it. He had safely brought away many foreign bodies in that way. He thought, however, that all these patients should have a general anæsthetic, then the coin-catcher could be used with great ease and delicacy: the body could be felt and could be pulled up without doing damage. Once, in a London operating theatre, he saw a young colleague trying to remove a coin. He missed it three times, and then he (the speaker) removed it with a coin-catcher without difficulty.

Dr. DOUGLAS GUTHRIE said that the President's remark regarding external surgery was applicable to foreign bodies in the air passages. He recalled a case in which a large piece of bone, impacted in the subglottic region of a child, was easily removed through a tracheotomy incision.¹ Had he (the speaker) tried to pull the bone through the glottis, considerable damage would have been done to the larynx.

With regard to Mr. Layton's remark that a foreign body in the œsophagus might cause symptoms resembling those of a foreign body in the air passages, he remembered a case in which a bone collar-stud had been in the œsophagus for three months, during which time the child had been treated for some obscure chest condition.² At the autopsy the stud was found to have ulcerated through the posterior wall and caused a pre-vertebral abscess. The symptoms were not those of difficulty in swallowing, but of trouble in the respiratory tract.

Mr. MICHAEL VLASTO asked whether Dr. Crow had ever found himself obliged to push a foreign body from the œsophagus into the stomach. He was far from wishing to convey the impression that he was recommending this as a routine method in dealing with foreign bodies in the œsophagus. Occasions had arisen, however, in his own practice, where he had considered it unsafe to extract forcibly such a foreign body as a fishbone for instance. A choice had to be made between the dramatic and the commonplace. Local application of adrenalin and cocaine to the site of impaction, and the gentle pressure of a bougie, had allowed the foreign body to pass into the stomach, with complete relief of symptoms.

Sir JAMES DUNDAS-GRANT said that before the introduction of endoscopic methods he had had occasion to use the coin-catcher, and had not known any harm to result. He was not now, however, altogether in favour of that instrument; whenever he had an endoscope at hand he used it. He instanced the case of a child who had swallowed a halfpenny, which became fixed in the œsophagus. It could not be seen by the ordinary endoscope, which went past it, but it was revealed by X-ray examination. He had brought from Germany a Killian's special endoscope, a very small one, for use in the case of children, and with that he had removed the halfpenny without difficulty.

Mr. W. S. THACKER NEVILLE said there were several reasons why coin-catchers should be relegated to the museum. If students were taught to use coin-catchers, they would be likely to use them for foreign bodies other than coins, and that practice would bring laryngology into disrepute. Another reason was that endoscopists should keep their hand in training, so that they would be ready to deal with a difficult case at any moment. Furthermore, coins were not always easy to remove; they might be behind the cricopharyngeus.

He was sorry, notwithstanding the wonderful record shown, that Dr. Crow did not use local anæsthesia for adults; without that he could not be a true disciple of Chevalier Jackson. Most of the adults who had swallowed a foreign body were very healthy, and many would stand half a grain of morphine, and with that and a small amount of cocaine paste (cocaine hydrochloride in adrenalin) applied to the pyriform fossæ and epiglottis, one could easily pass an œsophagoscope in one's consulting room. He (the speaker) was a strong advocate of local anæsthesia.

¹ See *Proceedings*, 1919, xiii (Sect. Laryng.), 37.

² See *Proceedings*, 1921, xiv (Sect. Laryng.), 63.

Mr. HERBERT TILLEY said he had not seen a coin-catcher for twenty years, and had never used one. He did not agree as to the advisability of teaching students to use the coin-catcher. Even in the heart of the country, if a person had swallowed a coin, it was possible, in these days of rapid transit, to obtain the services of an endoscopist within a few hours, and even if a coin were impacted for so long as 48 hours probably not much harm would result. He agreed with those who contended that to search blindly in the gullet for a foreign body was neither safe practice nor good teaching.

A point of interest was the frequency with which junior endoscopists missed a coin in the upper region of the œsophagus. On three or four occasions he had been asked to help, when the coin had not been detected, and the reason was that the patient's head had not been sufficiently flexed, and consequently the end of the tube over-rode the coin. If the head was well flexed, the upper edge of the coin would be seen, and it could be removed with appropriate forceps.

With regard to local anæsthesia, he advocated the application to each pyriform fossa of 10% to 15% cocaine solution. This produced an anæsthesia sufficient for passing an œsophagoscope.

Referring to the question as to whether one should allow a foreign body to pass on, or help it downwards, as Mr. Vlasto had suggested, he (Mr. Tilley) had had at least one interesting experience in that connection. He was asked to see a woman who was brought into hospital at midnight with a denture in the œsophagus. Inquiry elicited that there were no hooks on the denture, which the skiagram showed to be in the mid-thoracic region. He advised that a hypodermic of morphine be given, and said that he would see the patient in the morning. On passing the œsophagoscope no foreign body was detected, but a second screening showed it to be in the stomach, where it remained for a period of six weeks. He then asked Mr. W. Trotter what he thought was the best thing to do, and he advised leaving it alone, but suggested that good might result from giving the patient some butter-muslin to swallow with her meals. Two days after this had been done the plate was seen by the X-rays to have moved onwards, and two or three days afterwards the patient passed the tooth-plate securely wrapped in the butter-muslin.

Speaking of cellulitis in the neck: in 1926 he published some experiences concerning serious complications resulting from the swallowing of foreign bodies. An athletic and well-built cricketer consulted him giving a history of having swallowed a fish bone three days previously. He looked very ill, and had a temperature of 101° F. There was much cellulitis of the left side of the neck. Within two hours he was taken into a home, and the bone was found to be straddled across the gullet about the level of the episternal notch. He (Mr. Tilley) had disengaged the pointed end, and there was a gush of foul pus. The patient was very ill for a week, during which the cellulitis slowly subsided; after the pus had been evacuated he was given half a pint of warm milk containing two beaten-up eggs, through a stomach tube. No external operation was performed. For further details see *Brit. Med. Journ.*, 1927 (i), 1135 (Case IV).

Mr. ERIC WATSON-WILLIAMS said his own teaching and practice had been that both the coin-catcher and the probang should be in the museum. If a person swallowed a halfpenny there was no need to dash at once to do something vigorous and possibly disastrous. If the foreign body were a coin, it did no harm for two or three days. If it had sharp edges or points a tug might do great injury to the œsophagus, perhaps might even perforate it. It was better to bring the patient to a clinic properly equipped and staffed, which in this country was never far distant, and to pass an endoscope. Dealing with the extensive statistics of Guisez and Chevalier Jackson, he (the speaker) had analysed 1,000 endoscopies, and, with hardly an exception, the fatal cases of œsophageal trouble were due to unskilful attempts to remove the foreign body with the probang and similar instruments before the patients were brought to them for endoscopy. He had himself seen two cases of serious injury due to the use of the probang. It was very important to have a skiagram taken immediately before endoscopy. He had been asked to look in the upper air passages for a needle which was actually in the cæcum. A year ago he was asked to operate on a child, because the skiagram showed a brass disc at the level of the top of the sternum, but he insisted on another skiagram, and a later message said that the disc was in the stomach.

Mr. RITCHIE RODGER, referring to the question of deliberately forcing a foreign body downwards, said that many years ago a prisoner who had half a tooth-plate in the œsophagus was brought to him by the police surgeon. The house-surgeon prepared the patient with

cocaine, and the foreign body was easily removed in thirty seconds by means of the endoscope. A month later the man was brought again, having swallowed the other half of the plate. It was explained that after the first operation his trial for forgery had been postponed for twenty-eight days, and he had swallowed the second half hoping to secure a further postponement of the trial. In those days he (the speaker) had only had a jointed pair of forceps, and the joint became stuck. He therefore used a bougie and deliberately forced the foreign body into the stomach.

He understood that those who had spoken in favour of the coin-catcher agreed that it should be used only for coins. The trouble was that if its use was sanctioned at all, it could not be guaranteed that it would not be used for other foreign bodies.

Dr. CROW (in reply) said he was interested in Mr. Layton's downright criticism, though profoundly disagreeing with it. Elegance had an intrinsic value in surgery; the use of a coin-catcher for the removal of a coin, perhaps already sloughing half-way through the œsophageal wall, was, in his opinion, neither elegant nor safe. Indeed, he felt despondent that the Section should in any way hesitate in condemning blind methods.

With regard to the criticism of the method of anæsthesia, he would certainly stress the avoidance of "psychological trauma," but that was not the only consideration; one obtained much greater relaxation under general anæsthesia and consequently much greater ease of manipulation.

Congenital Stenosis of the Œsophagus in Children, Associated with Diaphragmatic Hernia of the Stomach.

By A. BROWN KELLY, M.D.

IN the course of the past two years I have examined, by the kindness of Professor Leonard Findlay, several young patients suffering apparently from frequent regurgitation, the underlying cause of which proved to be a congenital malformation of the œsophagus. In spite of having, for nearly a quarter of a century, used endoscopic methods when signs suggestive of œsophageal disease were present, I had not previously met with similar cases. I believe that I am right in assuming that the majority of laryngologists, even when attached to large general hospitals, are rarely requested to examine the œsophagus of a young child because of what appears to be persistent vomiting. When it becomes more generally known that this sign is occasionally of œsophageal origin it is to be hoped that the co-operation of the endoscopist, as well as that of the radiologist, will be sought at an early stage in order to assist in making the diagnosis and in carrying out intra-œsophageal treatment when practicable.

The object of this paper is to report four cases in which œsophageal stenosis in young children was associated with hernia of the lower end of the œsophagus and part of the stomach through the hiatus œsophageus into the thoracic cavity: This association, so far as I know, has not previously been pointed out.

Before describing the cases I shall make a few remarks regarding the varieties of hernia that may occur at the hiatus œsophageus. We are indebted to Åkerlund for an illuminating paper on this subject, published in 1926, based on the X-ray examination of twenty-four cases. Although the majority of his patients were adults, the deductions drawn from his investigations and the recommendations made as to methods of diagnosis are equally applicable to young children who constitute a fair proportion of the subjects of this disease.

Åkerlund proposed that this affection should be designated "diaphragmatic hernia of the œsophageal hiatus," or briefly "hiatal hernia." He differentiated three groups of cases: (1) Those in which the œsophagus is congenitally short and its junction with the stomach situated some distance above the diaphragm. As a consequence,

more or less of the stomach has herniated through the hiatus. All degrees may be met with: in Case I a minor degree exists. When the whole stomach or its greater part is in the chest the condition has been termed "thoracic stomach."

A thoracic stomach, however, need not be the result of herniation, as has been proved by Bailey, from the post-mortem examination of a man aged 77 years. The œsophagus was straight and ended at the level of the third costal cartilage; the body of the stomach was found in the thorax, and the pyloric antrum projected 6 cm. downwards into the abdomen. The explanation of the malposition which suggests itself is either hypoplasia of the œsophagus, or that the primitive stomach lay abnormally far forward on the alimentary canal.

(2) The second group consists of the parœsophageal hernias. In these a portion of the stomach slips up between the hiatal ring and the œsophagus and projects into the thoracic cavity, while the lower end of the œsophagus remains below the diaphragm. A congenital defect or weakness of the muscles bounding the hiatus has been regarded as a predisposing ætiological factor.

(3) The third group is made up of cases in which the abdominal part of the œsophagus, together with an adjoining part of the stomach, is herniated through the enlarged hiatus into the thorax. The cardiac end of the œsophagus is thus placed above the level of the diaphragm, consequently the œsophagus immediately above the hernial sac is likely to be relaxed and may become tortuous.

Cases of Group 1 are rarest and of Group 3 commonest.

Of the four cases to be described, three are from Professor Findlay's and one from Dr. Geoffrey Fleming's wards. I am indebted to these gentlemen for placing the clinical histories and skiagrams at my disposal. The X-ray examinations were made by Dr. D. C. Suttie, medical superintendent of the hospital.

I was concerned only with the diagnosis of the œsophageal affection, consequently my remarks as to symptoms and treatment will be brief.

In all the cases the pregnancy had been normal and the infant was healthy when born. Persistent vomiting or regurgitation was the outstanding—and sometimes the sole—disability for which the patients were brought to hospital. In all of them this set in immediately or a few days after birth.

Case I (Professor Findlay's patient).—D. T., male, aged 2 years and 7 months. From birth onwards for several months this child vomited after every feed; later the vomiting became less frequent. When admitted to hospital he was in the habit of taking several spoonfuls of food which, after being kept down for a minute or two, was partly regurgitated without effort. He was then pleased to resume his meal and the same sequence took place. On passing a stomach tube Dr. Findlay met with obstruction in the lower part of the gullet.

Excellent skiagrams of the œsophagus had been obtained but they proved puzzling to me until I made an œsophagoscopic examination. I shall describe this first.

On entering the œsophagus, considerable dilatation was found to a depth of 19 cm. from the upper teeth. The lumen then contracted abruptly and remained so for about 1 cm., beyond which it gradually opened out to the cardia, which presented signs of insufficiency. The rhythmical movements of dilatation and contraction were going on but the dilatation was unusually pronounced so that a good view of the interior of the stomach was obtained. This differed from what we are accustomed to see. Instead of finding the lower end of the tube being closed by folds of gastric mucosa one looked through the cardia into an open viscus in which rapid swirling movements were taking place. This observation suggested that the apparent dilatation of the lower part of the œsophagus in this patient and in two others previously examined was due to a hernia of the cardia and adjacent part of the stomach.

At a second examination, made recently, this view was confirmed. Again, at 21 cm. the cardia was seen opening and closing rhythmically, the amount of opening being unusual. Beyond the cardia was an open cavity which was similarly enlarging and contracting with inspiration and expiration. Its lining membrane was bright red and a swab rubbed on the wall gave a strongly acid reaction. (The œsophageal wall when tested thus was alkaline.)

On passing more deeply, to 27 cm., there was no longer a lumen, the end of the œsophagoscope being closed by folds of lining membrane, giving the picture ordinarily met with on entering the stomach.

The skiagram of an oblique view shows a large spindle-shaped dilatation of the œsophagus followed by a short constricted portion the length of which corresponds approximately to the breadth of a dorsal vertebra. The constriction is continued downwards into a gradually increasing dilatation extending to below the diaphragm where its shadow merges into that of the barium collected in the stomach. This lower dilatation I regard as consisting mainly of the upper part of the stomach.

A front view, taken a week later, shows the œsophagus above the stenosis again well distended. The lower dilatation is interrupted and consists of two parts, one lying above the diaphragm and represented by the compact collection of barium in front of the vertebral column and the other by the scattered masses of barium beneath the diaphragm. In the intervening space fine lines may be seen: these indicate the folds of gastric mucous membrane

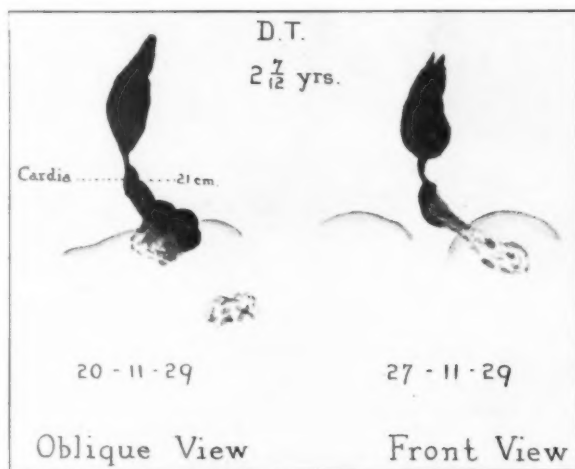


FIG. 1.—Case I. Congenital stenosis of œsophagus with hiatal hernia.

between the herniated part which has passed through the hiatus and the main body of the stomach. B 2

From inspection and measurements the cardia is a short distance below the lower end of the stenosis and about 21 cm. from the incisors. The average distance from the incisors to the cardia in a child of the patient's age is stated to be about 22 cm. In this case there seems to be congenital shortening of the œsophagus when its fairly direct course and the distance between the cardia and diaphragm are taken into consideration. If the measurements are approximately correct it is evident from the skiagrams that the cardia and a portion of the stomach are situated above the diaphragm. The appearances are therefore those of a hernia of the abdominal œsophagus, cardia and upper part of the stomach through the hiatus into the thorax.

Case II.—R. G., male, aged 6 years (under Professor Findlay).

This boy was breast-fed until 11 months old but feeds were always vomited. The vomiting has continued after every meal excepting during a few short periods. He has been in hospital several times. Œsophageal obstruction was detected at 21 cm. and X-ray examination showed a funnel-shaped stricture at the level of the seventh thoracic vertebra.

An œsophagoscopic examination was made when he was nearly 7 years old. At 24 cm.

a membranous stricture was found reducing the lumen to an elliptical opening of about 0.5 cm. in its long diameter; the stricture yielded easily to the œsophagoscope. The cardia at 26 cm. was unduly patent. The resiliency shown by the stricture, when the tube was withdrawn above it, suggested that the narrowing was due not only to the membranous ledge but also to a reduction of the lumen and entire wall of the gullet at the affected part. This condition probably also accounts for the patient's need of passing a bougie frequently.

In one of the skiagrams the lower part of the œsophagus is seen to pass into a conical dilatation which comes up through the diaphragm from the main mass of the stomach and resembles a hiatal hernia.



FIG. 2.—Case II.

Case III.—J. S., male, aged 8 years (under Professor Findlay).

This boy vomited after every breast-feed during the first three months of his life. With change to artificial diet all vomiting ceased. When he was 5 years old severe epigastric pain set in, with occasional vomiting. On admission to hospital occult blood was found in the stools. He was transferred to Mr. MacLennan who performed posterior gastro-enterostomy and removed the appendix. Temporarily he was improved but vomiting returned and he gradually became worse until, at the time of his re-admission, he vomited after every meal. There was no dysphagia. On passing the stomach tube Dr. Findlay encountered resistance at 28 cm.

The œsophagus was found to contain cloudy grey fluid and food debris, which were drained off. In the greater part of its length it was considerably dilated. At 24 cm. on the right wall an intensely red patch with a finely granular, readily bleeding surface was seen and was regarded as a peptic ulcer. At 26 to 27 cm. the endoscope could be passed no further owing to the funnel-shaped narrowing of the gullet; and at 28 cm. a Chevalier Jackson fine bougie was held up.

The skiagrams of the œsophagus filled with barium show dilatation to the level of the eighth dorsal vertebra. The lower end of the dilatation tapers to a thin tract, representing the stenosis, and passes directly downwards for a short distance. It then opens into a large sac—presumably a herniated portion of the stomach—lying above the diaphragm which, in

turn, communicates with the greater part of the stomach lying beneath the diaphragm. The constricted neck at the hiatus between the supra- and infra-diaphragmatic sections of the stomach is shown. The sinuous condition of the lower part of the œsophagus is due to the cardia being pushed upwards and is characteristic of the third group of hiatal hernias.

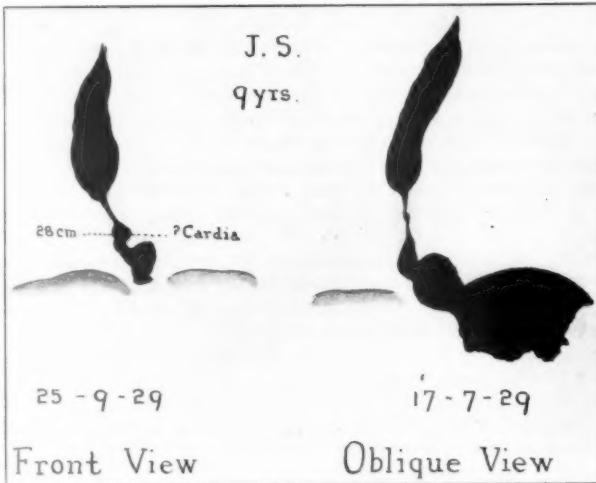


FIG. 3.—Case III.

Case IV.—A. G., male, aged 4 weeks (Dr. G. B. Fleming's patient).

This infant was brought to hospital because of vomiting after feeds. He took no food until the fourth day after birth; the vomiting then began. A stomach tube was held up at 20 cm. Dr. Fleming introduced through the tube, while at this depth, $1\frac{1}{2}$ oz. of barium and then examined by X-rays.

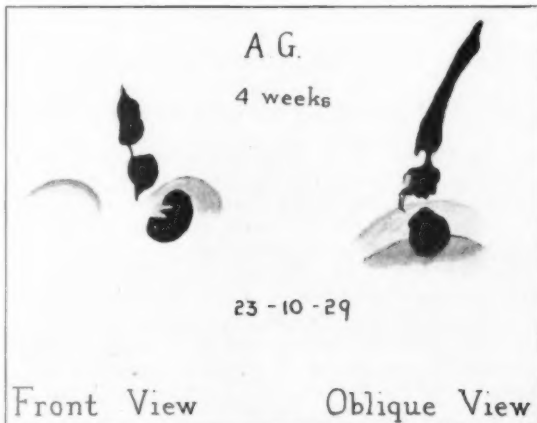


FIG. 4.—Case IV.

The skiagrams show three large collections of barium, one above the other. The uppermost represents a dilatation of the œsophagus above a stenosis. The middle sac is situated between the stenosis and the diaphragm and has all the appearance of a hiatal hernia. The lowest and largest is in the stomach. The hernia is of a larger size than at first appears. In one film the sac is well filled on the right side and contains only traces on the left side, whereas in another skiagram the reverse conditions are present.

How is the association of congenital stenosis of the œsophagus and hiatal hernia in the cases described to be explained? Some may regard it as accidental, but this is unlikely, as all four cases came under my observation within two years, and they were the only cases of congenital stenosis of the œsophagus that I saw during that period. There appears to be no doubt that both conditions may be congenital, and as the subject of one congenital malformation often presents one or more additional malformations, the cases under consideration may therefore be examples of multiple congenital abnormalities. Case IV supports this view, the hernia being pronounced, although the patient was only four weeks old. In the three older children the persisting vomiting and the insufficiency of the cardia in the two cases in which it could be inspected raised the question as to whether the hernia might not be produced by the pressure from behind, due to the vomiting. Certainly the vomiting was very frequent, but in reality it was regurgitation, which was easily effected, and was not accompanied by violent retching.

The most probable cause of the association not having been described earlier is, in my opinion, the difficulty of showing the hernia by X-rays. Special measures must be taken in order to distend the sac with barium; if this procedure is omitted, the hernia is likely to escape detection.

Mr. E. WATSON-WILLIAMS said that this paper explained a case which he had had six weeks ago, in a patient, aged 37, sent as a case of carcinoma of the œsophagus. There had been difficulty of swallowing for seventeen years, and there was a constriction midway down the chest. This opened easily before the œsophagoscope (under general anæsthesia), and he found himself looking at gastric mucosa, 36 cm. from the teeth. He confessed that he had been completely puzzled at the time.

Gradual Diathermy Destruction of the Faucial Tonsils.

By DAN MCKENZIE, M.D. (President).

DIATHERMY is applied to the tonsils under local anæsthesia, more or less profound, and in a few happy people no anæsthesia at all is necessary. As a rule, however, the anæsthetizing of the pharynx has to be pretty complete, and it is tedious and time-consuming.

With regard to the anæsthetic I am not perfectly satisfied with any. Cocaine is easily the best, but when applied to the pharynx it gives rise to toxic symptoms more readily than when it is applied in the nose or the larynx. At the present time I paint on adrenalin solution (1-3000) first of all, and follow it up with 10% solution of stovaine. After applying this for ten or twenty minutes I give one or two paintings with the usual cocaine (10%) and adrenalin (1-1000) mixture and then the infiltration of pillars and peritonsillar regions with novocain completes the process. In sensitive and nervous people a preliminary hypodermic of morphia (gr. $\frac{1}{4}$) and atropine (gr. $\frac{1}{100}$) is useful for calming fears and diminishing salivation.

I see statements made in the journals that surface anæsthesia alone suffices for the majority of patients. Of the patients who have come to me only one or two have been satisfied with such partial measures.

The electrodes used for the tonsil are five or six in number: two hooks (right and left) to reach the supratonsillar recess; a sharp-pointed pencil-shaped electrode,

particularly useful for the body of the tonsil; a flat electrode, insulated all round its circumference, for deeper areas (not often used); and—most useful of all—the simple needle electrode.

Electrodes should be short; the sets supplied by instrument-makers are much too long for this work and are apt to burn the tongue as well as the tonsil.

It is to be remembered that, unlike the galvano-cautery, diathermy electrodes do not sterilize themselves by their own heat. The surgeon must, therefore, be careful to attend to this important matter himself. I immerse electrodes and handles for half an hour in a bath of carbolic acid and then in a bath of alcohol.

Turning now to the application of the diathermy, the surgeon, it may be noted, is at liberty to do as much or as little as he pleases. When the tonsils are bulky and prominent, quite large portions may safely be destroyed at each sitting, the larger and thicker electrodes being used, but when the tonsils are small, and in any case when the destruction is nearing the capsule, it is advisable to proceed slowly.

Close to and beyond the capsule lie the larger vessels, and over-bold diathermizing of this region may lead to hæmorrhage, not at the moment, but days later, when the sloughs are separating, and, it may be, when the patient is out of our reach. The source of hæmorrhage is a vessel in or beneath the capsule. What happens is that the diathermy destroys a segment of the vessel wall, without coagulating the contained blood. The accident seems to be rare as a matter of fact, but it should be avoided by cautious diathermizing in depth.

By proceeding slowly as we approach the capsule—being satisfied, that is to say, with shallow coagulations—post-operative hæmorrhage can apparently be avoided. At least I have not so far been troubled seriously with any. When in the neighbourhood of the capsule, my plan is to employ the needle electrode, first because we can tell by its feel when we are in tonsil tissue proper and when we reach the tougher capsule, and secondly because the diathermy coagulation, about 1 cm. around the needle, does not extend much, if any, beyond the point. That is to say, with the needle we can estimate and determine the depth of coagulation, a control impossible with thicker, blunter electrodes. Naturally, when the needle is being used, the points of application must be multiplied. But if one is careful not to penetrate far beyond the capsule, serious bleeding is not likely to occur.

The device has been adopted of using two active electrodes both applied to the tonsil, an indifferent electrode being then unnecessary, and some workers speak highly of it. I find, however, that the single electrode is more easy to manipulate and control, and prefer it for that reason.

I may say that it is well to begin by coagulating the upper pole of the tonsil, particularly the parts around the supratonsillar recess (fig. 1).

The most difficult stage in the process is reached when the main mass of the tonsil has been destroyed, and we are dealing with the buried portion between the faucial pillars and high in the soft palate. It is astonishing how deep is the bed of the tonsil.

And now we must ask ourselves: how much of the tonsil should we remove? Must every trace of lymphoid tissue be annihilated, or is it sufficient to remove only so much as is necessary to prevent the accumulation and absorption of bacteria and their products from the crypts? This is a question which only time and experience can enable us to answer with certainty.

Clinical experience, no doubt, seems to indicate that tonsillectomy is preferable to tonsillotomY. But slicing a tonsil down to the pillars with a guillotine is very different from the diathermy destruction which follows the retreat of the tonsil as far as the capsule.

The diminution in the amount of toxic absorption, in the quantity, that is to say, of the poison, must, one may argue, lead to a moderation in the symptoms. Consequently, so far, I am keeping an open mind as to whether we should strive for total or subtotal removal. But the amount left should be as little as possible, and it is the case, of course, that with diathermy you can quite easily remove every particle of tonsil tissue. It is merely a matter of perseverance.

When the tonsil has retreated behind the pillars, precision in application is often a matter of difficulty. We ought, as far as possible, to keep the spot being diathermized in view in order to know when to cut off the current. (A little point of importance is that if we can, by the pressure of the shaft of the electrode, render the area being diathermized anæmic, the coagulation is hastened.)

Moreover, we try to preserve intact the pillars of the fauces and even the plica triangularis. So that when we have come within reach of what we may call the

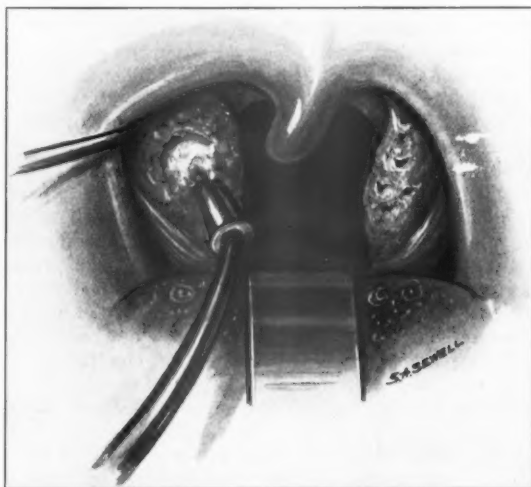


FIG. 1.—Application of electrode to tonsil, showing coagulation taking place.

capsular layer of the tonsil, the placing of the needle—say, in the upper pole under the hood of the soft palate—requires special attention. At this stage, a small blunt hook to hold back the anterior pillar is very serviceable and the concealed area is also made manifest if the patient extends his head and turns it a little to the same side as the tonsil on which we are working. Another good plan is to exercise pressure on the upper part of the anterior pillar so as to evert the body of the tonsil.

As I have already said, we avoid diathermizing the pillars, and that not only because it is unnecessary and therefore unsurgical, but also because it is apt to cause pain during the days following the diathermy. When, however, difficulty is experienced in reaching the upper pole, it is often convenient to coagulate the pillar over it so as to provide easier access.

When the treatment is nearing its end, allow several weeks' interval between séances, to give time for swelling to subside. Otherwise, there will always be tissue to diathermize.

When we have reached the last remnants of the tonsil, palpation with the finger will often disclose their presence and situation better than inspection. As in the ordinary operation, the lower pole of the tonsil near the tongue is apt to be overlooked. I have noticed that caseous débris-formation goes on until the last remains have vanished.

It is noteworthy that, in rheumatism from tonsil infection, improvement in the symptoms is often observed after the first application of the diathermy, probably because the heat sterilizes infected areas.

So impressive is this immediate improvement that if it does not occur I begin to doubt whether the symptoms are, in this particular case, pharyngogenic (to coin a word).

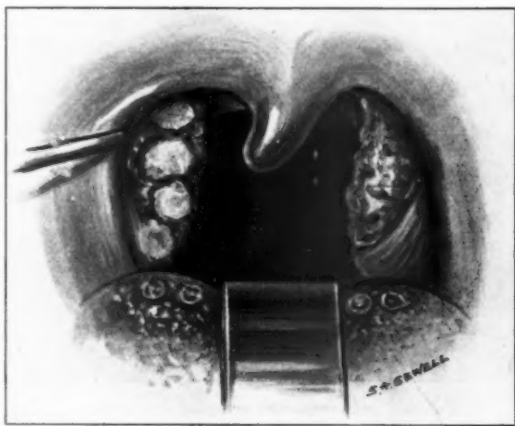


FIG. 2.—Tonsil at conclusion of séance showing coagulated areas.

The final result as regards the tonsil area is an empty fossa, with smooth denuded walls, and with both faucial pillars and plica triangularis intact. Some of the users of diathermy do not pay any attention to either of those two latter structures, but I think we ought to do so, and certainly when we do so the final picture is very pleasing to the conservative eye. There is little or no scarring apparent.

Perhaps I may add that to obtain so perfect a result, no little patience and considerable manipulative deftness and skill are necessary.

It is to be remembered that the operator can, at any séance, destroy as much or as little as he pleases. He can coagulate both tonsils entire at a single sitting if he wishes to do so. The drawbacks would be considerable post-operative pain, fœtor and soreness, and the risk of bleeding.

With regard to pain, more or less soreness follows most of even the ordinary séances, and it may be quite interfering for a day or two. Some people feel more than others. As we have already seen, the coagulation of any part of the pillars is apt to be painful.

In favourable cases, making slow advances, the results are gratifying, patients being relieved of their symptoms with a minimum of pain and inconvenience. When an old gentleman with a stiff knee and a groggy heart can by this means be enabled to resume his golf, for example, one feels that one has been of some use in the world.

But all cases are not so successful. Sometimes perfectly smooth tonsil beds will be obtained and yet the rheumatic symptoms will continue. Then many patients—and very naturally too—become weary of the long treatment and give up half-way. They do not, however, become any more weary of it than the surgeon does! Others again, and often just the very type for whom diathermy is physically best suited, are so nervous of anything to do with electricity, that it would be cruel to expose them to the treatment.

As a final contra-indication may I express the warning that diathermy destruction should not be used for genuine hæmophilics.

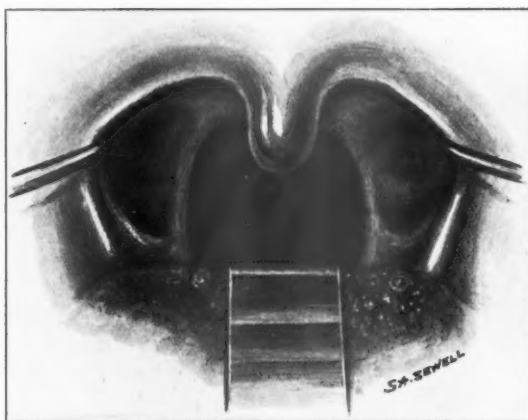


FIG. 3.—Tonsil bed after complete destruction.

Summing up the whole matter, I would say that the diathermy method of tonsil destruction is one of great flexibility, and that it is capable of the finest precision, but it demands considerable skill and attention to detail.

As it makes much less demand upon a patient's pluck and endurance than the ordinary tonsillectomy, we may look for it to become a popular method, not only among practitioners in general, but among ourselves. For it is to be remembered that it will supply us with the means of dealing with the tonsils in that large class of patients who, at the present time, prefer to endure their symptoms rather than run the risks and discomforts of the ordinary operation.

Discussion.—Dr. J. S. FRASER said he would like to know how the President performed the operation. In ordinary enucleation of the tonsil by the dissection method one separated the anterior pillar from the tonsil, and then proceeded to operate in an easy area, keeping close to the capsule; an assistant retracted the anterior pillar. Could that be done with the diathermy pencil or needle? Or did Dr. McKenzie destroy the tonsil much in the same way as it was supposed to be destroyed by London paste? He had had one or two cases in which the tonsil was supposed to have been destroyed by London paste, and in which he subsequently had to remove a very large tonsil stump which contained the so-called supratonsillar fossa, and had been the seat of numerous attacks of acute tonsillitis.

Did Dr. McKenzie make an incision with the diathermy knife through the plica triangularis and work in the space between the tonsil and its capsule, or did he attempt to

destroy the tonsil by coagulation from within outwards, in the same way as by the London paste method? In other words, could the diathermy knife or needle be used just as the scissors were used in ordinary dissection of the tonsil?

Mr. MUSGRAVE WOODMAN would like to hear more about removing the whole tonsil. London paste was condemned because it left the tonsil behind. He submitted that it was unwise to leave any portion of tonsil behind, whether it was treated by paste, by ordinary operation, or by diathermy.

Mr. H. BELL TAWSE said he had no experience of the treatment of septic tonsils by surgical diathermy, but he had recently seen a patient who was recovering from the application of this method. The surgeon's procedure, however, differed from Dr. McKenzie's; it was to be done at one, or perhaps two sittings, and was said to be a painless process under surface anaesthesia. The patient said that the operation was extremely painful; she was in bed four days with a temperature, and for ten days was unable to swallow comfortably. This experience had upset her nervous system, and there was some return of the symptoms of exophthalmic goitre, for which a portion of the thyroid gland had been removed two years previously. She was advised that a second application of diathermy would be necessary, but she had not the courage to face a similar ordeal, and, judging by the amount of tonsillar tissue still to be removed, several further sittings would appear to be necessary for complete destruction. The post-operative history of this case appeared to be more unpleasant than that following enucleation by dissection under local anaesthesia by injection, and as the operation had to be repeated, it was unlikely, in his opinion, to become popular with the general public.

Dr. McKenzie's method on the other hand was apparently painless, and would appeal to the few who could spare the time and possessed the means and the temperament. At the moment it seemed to be inapplicable to hospital practice, but improvements in technique might render surgical diathermy as useful for the removal of tonsils as for other lesions of the throat.

Dr. DAN MCKENZIE (in reply) said that if he did not use some sort of anaesthesia he would not get many patients, as at the beginning patients were alarmed. He employed surface anaesthesia and injected novocain. Separation of the anterior pillar was not necessary; one destroyed the tonsil from the inside, and, if one chose, the destruction could be carried through the pillar, or up to it, and stop there. There was no need to remove the capsule, but the operator could do so if he wished.

Pain and discomfort resulted if the operator was careless or ignorant, but if he proceeded cautiously, diathermizing only a little at a time, and produced anaesthesia before beginning, there would not be pain.

He was sure there was a numerous class who would not submit to the ordinary operation, but would submit to diathermy. After a careful operation by this method there would be no more than a little residual soreness. The great drawback to diathermy was its tediousness; it might have to be carried out every week or fortnight for three, four or more months, but the final result was admirable.

Granuloma of the Larynx following Exposure to Mustard Gas.

By E. WATSON-WILLIAMS, M.C.

"NEOPLASMS of the larynx, whether innocent or malignant, are uncommon—one might even say they are extremely rare. . . . A granuloma must be a rare occurrence in the larynx; it cannot be looked upon as a neoplasm *sui generis*, it is but an inflammatory manifestation of some irritation. . . . It may have a specific cause such as tuberculosis or syphilis, or a traumatic origin, such as a foreign body or the wound of a laryngo-fissure" (Sir StClair Thomson).

The object of this communication is to establish that the trauma inflicted by mustard or other irritant gas may produce a granuloma. The typical clinical history appears to be: Exposure to gas, followed by hoarseness, often relatively slight,

after the subsidence of acute symptoms; a latent period of some years, during which there persists a variable degree of painless hoarseness, with some tendency to get worse; the onset finally of symptoms of laryngeal obstruction, and perhaps aphonia, both often intermittent. Cough and sputum are inconspicuous, and the general health may remain robust. On examination, one finds a semi-pedunculated, slightly crenated, reddish tumescence, most often springing from the subglottic region just below the anterior commissure, and sometimes sufficiently movable to be blown up between the cords. When removed it is found to be composed entirely of granulation tissue with a squamous epithelial covering. Clinical and laboratory evidence of syphilis and of tubercle is negative.

A point of special interest is the long interval that may intervene between exposure to gas and the discovery of the granuloma: in Mr. Tilley's case it was fifteen months; in Mr. Bell Tawse's, fourteen years; in my own cases, five years and a half, seven years, and nine years respectively. In support of the ætiological claim, against which the length of this interval might be objected, there is nearly always some continuity of symptoms between the granuloma and the original gassing to which all the patients attribute their disease. And in the second place, apart from operation, syphilis and tubercle, granuloma of the larynx appears to be of extraordinary rarity.

As to rarity: personal inquiry has been made from every Member of this Section, and through journals circulating in this country, America, Belgium, France, Italy, Portugal, Austria, Germany, Holland and Switzerland. I have received a number of replies to the effect that the writer has never seen a case; only the cases reported below have come to light. The War Office, Admiralty, Air and Pensions Ministries, and the American Chemical Warfare Service have likewise no record of any cases.

In the literature I have been able to find only three relevant cases, to which, by the kindness of the authors, I am allowed to refer.

Case I. (Dr. Thrasher)¹. *Granuloma of the larynx after inhalation of flames.*—An adult male was involved in an explosion of coal gas, and suffered from acute laryngitis. Two months later he was found to have several granulomata springing from the laryngeal ventricles, and almost completely hiding the vocal cords. Operative removal was carried out in several sessions by the indirect method, and revealed that there were also a number of subglottic granulomata. Between the cords and just below them, two small reddish bodies could be seen during forced expiration. Section showed the structure to be "papillomatous neoplasm with admixture of granulation tissue."

Case II. Sir StClair Thomson. (*Apparently Spontaneous*) *Granuloma of the Vocal Cord.*²—The patient, Frederick M—, aged 40, came to the clinic on September 12, 1911, complaining only of hoarseness for the previous two months. The case book describes the growth as "a pedunculated, mobile tumour, adherent to the free edge of the right vocal cord, just in front of the processus vocalis. The growth is ovoid, smooth, purplish, and the unattached extremity is slightly yellowish and puckered. During inspiration it falls below the glottis. The right cord moves freely, and is only slightly injected. Some enlarged glands at the angle of jaw."

On November 7, 1911, the growth was removed entire, with Mackenzie forceps, by the indirect method. The report from the pathologist was as follows: "The tumour consists of fibrin and granulation tissue. It is covered by a squamous-celled epithelium, which shows no evidence of malignant change. Diagnosis: granuloma (Percy B. Ridge)."

The after-history of the case is brief. The larynx was left quite clear. The patient was seen at intervals afterwards, the last note being dated March 19, 1912, four months after the operation, when there was no trace of growth, and no suspicion of recurrence.

Case III. (Mr. Herbert Tilley)³. *Granuloma of the trachea following mustard gas.*—Capt. R. was gassed on March 21, 1918, but remained some hours on duty until his eyes closed

¹ *Laryngoscope*, 1906, vol. xvi, p. 780. *Journ. Laryng., Rhinol and Otol.*, 1906, vol. xxi, p. 880.

² *Journ. Laryng. and Otol.*, 1915, vol. xxx, p. 425.

³ *Journ. Laryng. and Otol.*, 1920, xxxv, 1; *Proc. Roy. Soc. Med.* 1919, vol. xiii (Sect. Laryng. 3).

up. He was in bed fourteen days, and then sent home for twelve weeks and during this time his only trouble was a sense of difficulty in breathing, when he hurried. In October there was still dyspnoea on exertion, and occasional matutinal hæmoptysis. He was demobilized in January, 1919: disability 20%, dyspnoic on exertion. June 1919, marked stridor, impeded inspiration and expiration, feeble breath sounds over right lung. Sputum, pus, blood-cells, numerous organisms, no tubercle bacilli. On examination the larynx was normal but the lower end of the trachea was almost occluded by a pale reddish-grey tumour which moved upwards and downwards with respiration, attached to the right side and close to the right bronchus. The growth was with great difficulty removed by direct tracheoscopy. It was the size of a small cherry and somewhat pedunculated, deeply lobulated, the surface finely papillary. Microscopically it was found to be a papillary granuloma.

My own cases, the first of which I showed and published in 1923, are as follows:—

Case IV.—Mr. A. W. B., aged 29, came to me in January, 1923, complaining of hoarseness, which had gradually been coming on since August, 1917, when he had been exposed to mustard gas, but not evacuated from the line. At first it was quite slight (my clerk's note is, "Hoarseness during last four years, i.e. since 1919"), and only during the last six months had it become really very conspicuous, and was getting worse. The voice varied, being always worse in wet weather, but during the recent bad period it had on several occasions entirely failed, sometimes in the middle of a word, with a sensation of choking. He had been in receipt of a pension for "D.A.H." of which the chief feature was breathlessness, and had been under observation in Edinburgh in 1918. On several occasions he had had very severe attacks of dyspnoea, especially when riding up hill on his bicycle, and had had to be helped home at times. When the attacks came on, the hoarseness was notably more pronounced.

On examination I found a tumescence in the lumen of the larynx, "a not quite smooth, roundish body attached in front and (?) to left cord, partly between cords." In view of my report, "Laryngeal neoplasm or (?) granuloma. The exact nature can only be determined after section," and the provisional diagnosis of laryngeal fibroma, the patient was refused further pension, his condition being considered constitutional. There were no physical signs of tuberculosis, though I cannot find any record of sputum, or of its examination; the Wassermann reaction was negative.

By direct laryngoscopy the mass was seen to occupy approximately half the antero-posterior diameter of the larynx; it appeared finely mammillated, softish, and attached by a rather broad pedicle to the subglottic region anteriorly and somewhat to the left. Its colour was a pale cream, though by indirect laryngoscopy it had seemed more definitely pink (figs. 1 and 2). It was removed with Paterson's laryngeal forceps, the bulk in one mass, and remnants subsequently. The pathologist's report was "Simple granulation tissue; no evidence of malignancy" (fig. 3). The patient was completely relieved by the operation, and his claim to pension (up to the date of operation) was admitted as a result of the report. I have no doubt that the granuloma was the direct though apparently late result of mustard-gas inhalation.

Case V.—Lieutenant J. R. W., aged 29, came to me on July 18, 1924, with the diagnosis of "polypus of larynx." In 1917 he had been gassed by mustard and other gas. Since then after the initial laryngitis he had been always hoarse, and, when I saw him, had the voice of a severe chronic laryngitis; there was no pain, very little expectoration, and the general health was good.

On examination I found the vocal cords injected: there was no ulceration, or alteration in movement: "A smooth reddish body, like a cock's comb, apparently attached at, or just below, the anterior commissure, probably a granuloma" (fig. 4). The chest showed no evidence of disease, and repeated sputum examinations had failed to show tubercle bacilli; there were no signs or history of syphilis, but the Wassermann reaction was not tested.

Two days later, under general anaesthesia, I carried out direct laryngoscopy, and confirmed the appearance and position of the growth. It was attached by a longitudinal base in the subglottic region, the upper end of the attachment reaching just up to the lower edge of the cords. I have no record of the growth coming between the cords, and think that it did not. The growth was removed piecemeal with punch forceps, as Paterson's forceps could not be brought to bear on the base. The pathologist's report was: "Granuloma; no

4 Bristol Med.-Chir. Journ., 1923, xl, 154.

trace of tubercle or new growth." On July 29 the laryngitis was "much improved." The patient went home and I have not since been able to trace him.

Case VI.—Mr. A. W., 32, came to me in March, 1926, complaining of hoarseness since he was gassed at Corbie in 1917, not getting any worse. The condition was painless. During recent months he had been having attacks of breathlessness. Atrophic rhinitis was present, but had not attracted his attention, and his pension was on account of "laryngitis." On examination I found a round, smooth cherry-red body attached to the anterior commissure of the larynx, or a little below this, and about one-third of an inch in length. It moved freely, and in expiration was blown up through the glottis. The Wassermann reaction and sputum examinations were negative, and there were no physical signs in the chest, although the skiagram of the latter showed a generalized fibrosis. I made a diagnosis of granuloma, although "fibroma" was suggested as more probable. By direct laryngoscopy the little mass was readily removed. On section it was found to be composed of loosely arranged granulation tissue, with considerable vascular development (fig. 5). Two months later the larynx showed no signs of abnormality beyond a generalized laryngitis, apparently chronic catarrhal. The condition has remained unchanged until the present time.

Case VII.—Mr. R. C., a middle-aged man, came to me in February, 1926, for a report on his larynx; he had been slightly hoarse for many years, i.e., before the war, and did not think his hoarseness had been worse since he had been in France; he had been employed in repair of roads, and the history of gassing was vague. He was in receipt of a pension for bronchitis.

On examination I found, deep to the vocal cords below the anterior commissure, a small sessile greyish-pink semi-translucent body, looking like a small nasal polypus. Treatment was refused, so that the nature of the body is unknown; and there are no data to indicate how long it had been present, or whether it had in fact any connection with gassing. The record is included here, as this is the only tumescence which I have seen, in site and general appearance much resembling the granuloma of the larynx described; and it is curious that it occurred in an ex-soldier who claimed to have been exposed to gas, though without injury.

Case VIII. (Mr. H. Bell Tawse).—Reported in *Proceedings*, 1930, xxiii, 784 (Sect. Laryng., 26), 1417 (Sect. Laryng. 59).

Case IX. (Mr. F. C. W. Capps).—Reported in *Proceedings*, 1930, xxiii, 791 (Sect. Laryng. 33).

Further Report.—A provocative dose of novarsenobillon was given and the Wassermann test was repeated. The reaction was again doubtful.

February 17, 1930. Operation: As much of the growth as could possibly be removed was excised under local anaesthesia.

A microscopical section showed much round-celled infiltration and other evidence of chronic inflammatory changes; there was no sign of malignancy; some areas showed polymorphonuclear infiltration indicating a certain amount of suppurative degeneration.

The patient's airway was greatly improved after the operation, and his voice, though not good, was very much better. The swelling was found, on direct laryngoscopy, to be a large single one and appeared to be more in the nature of a prolapse from the left ventricle.

The patient then had a complete course of novarsenobillon treatment and he continued to show steady improvement. He was last seen on May 14, when he still had a small polypoid swelling near the anterior commissure. The voice and breathing were good.

Dr. Jobson Horne reports that he has seen cases of granuloma of the larynx due to mustard-gas poisoning, but is unable to supply details. *Proceedings*, 1930, xxiii, 785 (Sect. Laryng. 27).

Communication from Mr. W. J. Harrison:—

"I am afraid I cannot give you the details which are necessary to make the cases of any value.

No. 1 had been receiving a pension on account of tuberculosis of lung, and was sent to the hospital for observation. There was a history of gassing and bronchitis, but with which particular gas and at what date I cannot remember. No sign of tuberculosis could be found by X-rays or other means when he was in hospital, and I was asked to examine him on account of persistent hoarseness, to see if there was any suggestion of tuberculosis of the larynx. I found the cords congested, and a small growth situated at the anterior commissure.



FIG. 1.—Case IV.



FIG. 2.—Case IV. Granuloma after removal, actual size.



FIG. 3.—Case IV. Section of granuloma. $\times 110$.

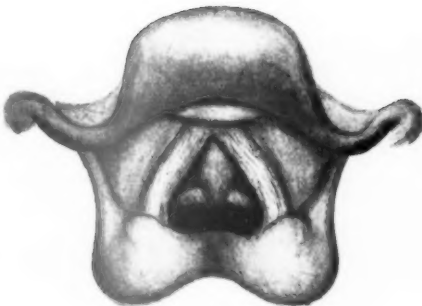


FIG. 4.—Case V.

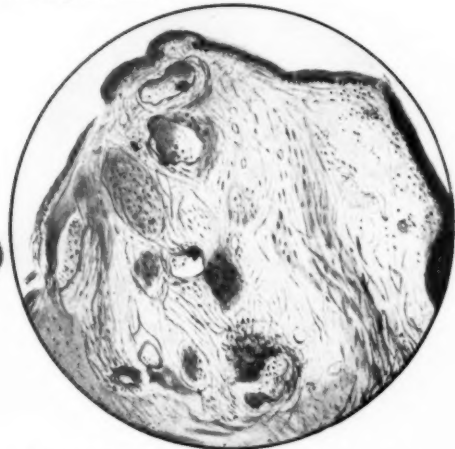
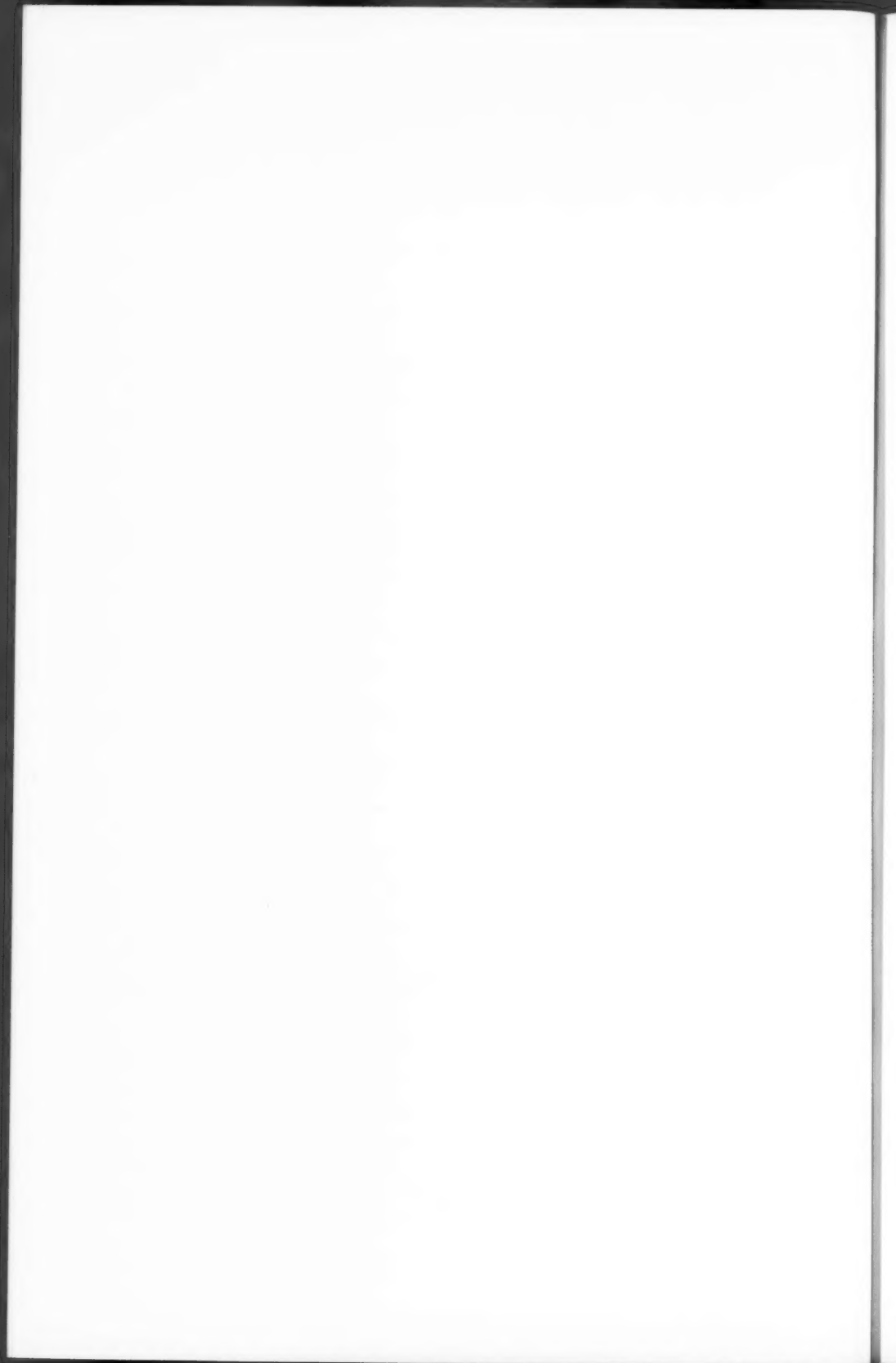


FIG. 5.—Case VI. Section of granuloma. $\times 100$.



No. 2 came as an out-patient at another hospital, complaining of sudden alterations in his voice which he said had been weaker since the symptom had developed. There was a small pedunculated growth just below the anterior commissure, which could be seen every now and then to come up and be grasped between the cords."

Communication from Dr. J. Nouailhac, of Brive, Bordeaux :—

"Mons. D. (pharmacist) had been in good health before the war; no syphilis or tuberculosis. During the war he was gassed on several occasions, and in particular during 1917 at Verdun (mustard-gas, arsine), following which he was a month in hospital. Since the war he has been always fragile, catches cold readily, the voice is always hoarse; he suffers from hawkings and distressing attacks of cough. In 1920 he was given a pension for catarrhal rhinitis, laryngitis, and a cyst of the epiglottis, consecutive to gassing. First seen in April, 1928. The vocal cords were a little red, with some interarytenoid infiltration. A little tumour the size of a pea, sessile, of rosy colour, and soft consistence was found in the right glosso-epiglottic recess. It has been under observation since that time, but has remained quite stationary, and since it has caused no symptoms, has not been submitted to operation. Its histology remains therefore unknown, but the appearance closely resembles that of a nasal polypus."

Sir STCLAIR THOMSON said that all these laryngeal growths were very interesting. Only about 1 in 5,000 patients attending an oto-laryngeal clinic had a laryngeal tumour, therefore records were collected very slowly. In his own case he had suggested that the tumour originated from a submucous hemorrhage. These conditions might result from violent action taking place in the larynx. Perhaps Mr. Watson-Williams might like to look up Sir Felix Semon's cases of hemorrhage of vocal cords simulating malignant disease.

The Use of Avertin in Oto-Rhinology.

By W. S. THACKER NEVILLE, F.R.C.S.Ed.

AVERTIN, a simple organic compound of bromine, was first made in Germany in 1926, where it was seen in December, 1927, by Basil Hughes, of Bradford, who was largely instrumental in introducing it to this country.

I have used avertin in twenty-eight cases. In only one case did I get complete anaesthesia without local or general anaesthesia. The solution can be given by a nurse or family doctor in the patient's room or in the patient's own home before entering the nursing home. After an interval of between thirty and sixty minutes, a local anaesthetic consisting of novocain 0.125 grm., potassium sulphate 0.1 grm., normal saline 25 c.c., has to be injected or ether has to be administered, for I have not aimed at complete anaesthesia with avertin. Avertin in safe doses is not an anaesthetic—it is a basal narcotic. When ether was employed the patient was unaware of its administration. Furthermore, so little ether was necessary that the after-effects were over before the patient recovered from the avertin.

My method of preparing the patient and the solution was as follows:—The evening before operation, the patient was weighed after his bath and then an enema was administered. On the morning of the operation, morphine gr. $\frac{1}{4}$ or $\frac{1}{2}$ was given half an hour before the avertin was injected.

The table issued by the makers was consulted and on this chart opposite the patient's weight, was found the number of c.c.'s of fluid avertin and the amount of distilled water that was to be added. The amount to be given is calculated in this table on the basis of 0.1 gramme per kilogramme of patient's weight (1 cm. of avertin fluid corresponds to 1 grm. of avertin powder). The amount of the distilled water was measured out and was heated in a flask to body heat. The avertin fluid was now measured out and added to this flask. The fluid, which is oily, was mixed

with the water by shaking the flask vigorously. To prevent cooling, we generally held it under the hot tap as we mixed it. When mixed, 5 c.c. of the fluid was poured into a test-tube and one drop of Congo red was added. If the colour was pink, the mixture in the flask was at once handed to the nurse who injected it into the rectum through a thin rubber tube. If the reaction with Congo red resulted in a blue colour, the fluid would be rejected.

Almost immediately after the injection, the patients became unconscious, though they did not lose their reflexes. In order to avoid the danger of the jaw falling back, a clip was inserted into the tongue and the patient was watched by a nurse. As most of the operations have been performed under local anaesthesia, instead of ether, in addition to the avertin, we let an hour elapse before the patient was brought to the theatre. It takes from twenty to thirty minutes for the anaesthetic to act fully and then the effects will last from two to four hours. Even after an hour the pharyngeal reflex is still present and so it is necessary to insert an intranasal or postnasal plug, as otherwise the blood falling back into the pharynx will make the patient cough and become restless. The insertion of the postnasal plug disturbs the patient too much, so I now employ an intranasal plug of gauze. The retention of the cough reflex is an advantage in that, with the addition of ether, a tonsillectomy can safely be carried out, without incurring the danger of aspiration of the blood. Before the postnasal plug was inserted, each nostril was anaesthetized by three cotton-covered probes dipped in cocaine mud.

In a case of a Caldwell-Luc operation, the field of operation was anaesthetized with the local anaesthetic mentioned above. During the operation the patient was sometimes slightly cyanosed, and respiration was shallow, the rate being increased. The blood-pressure fell, and, therefore, when the operations had been completed, lobeline and ephedrine were injected. The lobeline caused the patient to breathe deeply, whilst the ephedrine raised the blood-pressure. In our early cases we washed out the rectum when the operation was completed, but in one case the wash-out evidently distributed the avertin more widely, as the patient, after awakening, passed into a deep sleep for about six hours; so in other patients we merely passed a rectal tube, and latterly we have even given this up as we found the patient usually awakened two or three hours after the rectal administration.

The great advantage of this anaesthetic is that the patient, no matter how restless, knows nothing of the operation, and, at times, nothing of the after-effects.

The disadvantage of employing this form of basal narcosis with local anaesthesia is that the patient becomes restless, moving the hands and legs if he feels the slightest pain. So one must anaesthetize the nose more thoroughly than in the usual form of narco-anaesthesia which I employ—namely, "twilight sleep." While the nose is being anaesthetized the patient moves his head from side to side. Thus in performing an operation under surface anaesthesia, one must have a nurse to fix the head and another to watch and possibly control the arms and legs.

When one employs novocain infiltration, as in the case of a Caldwell-Luc operation, the patient remains quiet during the whole operation. Ether was administered to four patients: two were to undergo tonsillectomy, one a double mastoid operation, and one—a child, aged 12—an intranasal operation. A boy, aged 8, who was said to require tonsillectomy, refused to open his mouth when he was being examined. However, as the tonsillar cervical glands were large and the tympanic membranes retracted, we decided to remove the tonsils. He refused to go to the nursing home or allow a nurse to approach him, so I prepared the avertin and gave it in a "thermos" flask to the family physician, who injected it into the rectum whilst the boy was in his bed. The child fell asleep in three minutes, and was then driven to the nursing home and anaesthetized with ether. On waking hours later, he wanted to know how he had got to the nursing home without crying.

A man, aged 27, who dreaded tonsillectomy and postponed it for two years

because of his fear of the anæsthetic, faced the operation cheerfully when avertin was offered.

On a child, aged 12, I performed a submucous resection of the septum, middle turbinectomy and intranasal opening of both the maxillary sinuses. After the nose had been cocaineized, a small quantity of ether was administered, but during most of the operation I worked without the anæsthetist. When the patient became restless, the anæsthetist stepped forward and allowed the patient to inhale ether. The operation was almost bloodless, and thus differed from those which I have performed under full anæsthesia where the bleeding demanded repeated sponging. Probably we all prefer chloroform if a general anæsthetic is employed in nasal operations. Avertin avoids the necessity of employing chloroform and so allows one to use ether and inject adrenaline with safety.

The one patient who was operated on without local or general anæsthesia was aged 58. He had a large carcinoma on the lateral wall of the laryngo-pharynx. After receiving avertin he became cyanosed and his breathing was very shallow. I performed tracheotomy, removed the ala of the thyroid cartilage, and opened the larynx and pharynx. I inserted twelve needles of radium into the growth. The operation lasted two hours. The patient recovered consciousness three hours after the administration of the avertin. He would not cough and his breathing was laboured. He complained of epigastric pain and died sixteen hours after the completion of the operations. This case shows that in cachectic patients, the weight is not the only guide for dosage, but when the general condition is poor, the dosage must be reduced and the fractional method as adopted by Morrin and Hirsch must be employed.

This case also shows that avertin is contra-indicated in all laryngeal operations, as the patient would not cough even after he had recovered from the avertin.

To sum up: avertin is an ideal form of basal narcosis when ether is added or infiltrated anæsthesia employed. Thus it may be employed in the case of an external frontal sinus operation or a Caldwell-Luc operation in combination with local anæsthesia, or in the case of a tonsillectomy or mastoid operation, in combination with ether. It is also an ideal anæsthetic when combined with ether in the case of an intranasal operation on children under 14, in whom, I believe, morphine and scopolamine are contra-indicated on account of the excitability produced by the scopolamine.

Avertin is unsuitable when one merely employs surface anæsthesia and so should not be used for septum, ethmoid, sphenoid or intranasal maxillary sinus operations, all of which can be quite well carried out with morphine and scopolamine and local anæsthesia.

Discussion.—Sir STCLAIR THOMSON said he was surprised to hear Mr. Thacker Neville use the term "ideal" in recommending this substance, as he (the speaker) would have thought, after all the "wild excursions and alarms" recorded, that the paper was written to warn laryngologists off avertin! It was difficult to know how much in these cases was due to the avertin and how much to the variegated mixture of other drugs used at the same time. It might be very well to keep the cough reflex in check for a little while, but to have the patient unconscious for two hours and sleepy for three days was something to be strenuously avoided in laryngeal surgery. He was not altogether prejudiced in this matter, for his colleague, Mr. Lionel Colledge, had tried and abandoned avertin. The danger was the absence of reaction in these patients. The long period of unconsciousness would certainly result in a heavy death-rate in laryngeal surgery.

Dr. LESLIE POWELL said his anæsthetist had used avertin for a few of his cases, and he (the speaker) had been anxious about it. In the first of these, although the operation was a simple one, the case had ended fatally from sudden respiratory failure about six hours later. Since then patients had been carefully watched. There was nobody watching this patient at the moment and she died. Resuscitation was said to be easy if attention was given at the

first sign of respiratory failure, but this might happen many hours after the operation. He did not regard avertin as a safe anæsthetic.

Mr. V. E. NEGUS said he had not had personal experience of avertin because by using morphine and scopolamine and nerve blockage by wool-tipped probes passed up to the region of the nasal nerve and sphenopalatine foramen, it was possible to perform such operations as ethmoidectomy with the patient still carrying on a conversation and keeping quiet. It was hopeless to attempt any intranasal operation if the patient was restless and constantly moving about. It was difficult to see what were the advantages of avertin for these operations.

Mr. THACKER NEVILLE (in reply) said he agreed with Sir StClair Thomson that avertin was not suitable for laryngeal cases. He had already emphasized—in his comment on the last case recorded in his paper—the important point that this anæsthetic was contra-indicated in all laryngeal operations. Even for ordinary nasal work he preferred morphine and scopolamine and block anæsthesia. The only cases in which avertin was desirable were those in which one could use ether or infiltration anæsthesia.

Its chief value was its psychological effect on adults and it was useful in operations for sinusitis in children. He had given morphine and scopolamine to children under 14, but they had got out of bed and torn up the sheets. For children addition of ether was advisable.

Section of Obstetrics and Gynaecology.

[May 16, 1930.]

The Toxæmias of Pregnancy: A New Conception.

By G. W. THEOBALD, M.D.

[ABSTRACT.]

THE geographical distribution of the disease, the marked decline in its incidence in Germany during the Great War, its virtual elimination by conscientious antenatal care, and the fact that more than 50% of the full-term children born to women suffering from the disease are apparently healthy, make it impossible to accept the hypothesis that a diffusible placental toxin is the cause of eclampsia. Dr. J. Young is the only author who has attempted to correlate pathological changes in the placenta with eclampsia, but his conclusions are untenable for several reasons. The experiments of Wooldridge, reported in 1889, and confirmed by Schmorl, divest Young's experiments on guinea-pigs of any great significance, and I myself have carried out experiments which prove that the partial separation of the placenta in pregnant bitches does not cause any toxæmia.

With regard to the significance of albuminuria: unequivocal cases of eclampsia without albuminuria have occurred. Again, albuminuria is sometimes caused by rapidly growing benign ovarian tumours. I have caused albumin to be passed in the urine of healthy men and women by keeping them in a modified Walcher's position for thirty or forty minutes. Moreover, F. R. Winton has shown that it is possible to cause a reversible albuminuria in a dog by increasing the pressure in the renal vein of an isolated kidney. These facts, taken in conjunction with the pathological changes seen in the kidneys of women dying from eclampsia, make it impossible to believe that the disease is caused by, or even necessarily associated with, functional or organic defects in the kidneys. My own belief is that the toxæmias of pregnancy are caused by toxins absorbed from the bowel, which have not been detoxicated, owing to the breakdown in the normal mechanism of defence of the body. Among the metabolic changes normally associated with pregnancy, the most important are: a marked increase of fat, lecithin, cholesterol and fibrinogen in the blood; a severe diminution of the glycogen content of the liver and muscles; a lowering of the carbon-dioxide tension and a decrease in the carbon-dioxide combining power of the blood. Then, too, the mother has to undertake some of the metabolic functions for the child, and get rid of the waste products of its metabolism, while the growing foetus deprives the mother of considerable supplies of such important substances as calcium, iron, iodine, and sugar. At the same time, the bulk of the uterus embarrasses the intestines, and causes intestinal stasis and possibly albuminuria.

It is generally believed that toxins of chemical and bacterial origin absorbed from the bowel are detoxicated and conjugated in the liver, but although such toxins certainly damage the liver, there is no example in medicine of a complete breakdown of the liver being caused by them. So sudden and severe an upset of the functions of the liver as is associated with eclampsia, could only be caused by them if a breakdown had occurred in the detoxicating mechanism. The toxins would then be free to damage the liver, invade the blood-stream, and poison the whole body, their nature and quantity depending on the food ingested and the degree of intestinal stasis present. It would appear from the action of calcium in protecting dogs against the toxicity of such poisons as carbon tetrachloride, guanidine, bile-pigments and sodium oxalate that the presence of calcium ions in the blood is necessary to the liver in the carrying out of its detoxicating functions. The available supply of

calcium may be deficient for the following reasons: (a) Deficient intake, (b) deficient absorption, (c) increased elimination, associated with an acid urine, (d) a certain quantity is required for colostrum, (e) the foetus requires about 8 g. during the last four weeks of pregnancy, although the total amount circulating in the mother's blood is 0.5 g. Two facts of great importance are: (1) that the available supply of calcium can only be used if the parathyroids are functioning properly and an adequate supply of vitamin D is assured; (2) that there is at present no known method of measuring the ionized calcium in the blood, which alone is of significance in defending the body against toxins.

The diet in pregnancy should be complete quantitatively and qualitatively and should contain a sufficiency of all the vitamins. Pregnancy frequently lays bare deficiencies in the diet, e.g., in beri-beri, osteomalacia, etc. Not only must the diet be complete, but it must be assimilated, and there is reason to believe that the psychological traumata associated with marriage, pregnancy, and the fear of labour, upset the digestion and disturb the due absorption of food. Moreover, the bulk of the uterus not only interferes with the assimilation of food, but is a direct cause of intestinal stasis, and so contributes to a vicious circle. All the evidence goes to prove that sunlight, absence of worry, and a diet having a low protein content go hand in hand with a low incidence, not only of the toxæmias of pregnancy, but also of all diseases of the intestinal tract.

The probable genesis of an attack of eclampsia is as follows: So soon as the functions of the liver are disturbed by the toxins from the bowel, the complete metabolism of meat becomes impossible and an excess of guanidine appears in the blood. Guanidine is antagonistic to the already deficient blood-calcium ions and lowers the blood-sugar, a sudden drop in the level of which is associated with convulsions. Further damage to the liver interferes with the formation of anti-thrombin, and the excess of fibrinogen in the blood, unopposed, causes hæmorrhages in various parts of the body. The toxins from the bowel, no longer detoxicated, continue to damage the liver and are absorbed in amounts depending on the food eaten and the degree of intestinal stasis present, and then, entering the general circulation, they poison the whole body. The fits may be accounted for in one or more of three ways: (a) a sudden drop in the level of the blood-sugar associated with a hypocalcæmia; (b) œdema of—or hæmorrhage into—the brain; (c) the direct action of the toxins on the central nervous system. It is a mistake to think of the syndrome "eclampsia" as a specific disease, and to assume that the symptoms are always caused in the same way.

[Dr. Theobald then summarized various experiments which he had performed.]

By feeding dogs on a lean meat and water diet, it is possible to cause a severe degeneration of the liver, the sections showing recent and hyaline thrombi in the veins and capillaries, cellular necrosis and hæmorrhages into the periphery of the lobules. The kidneys of these animals show a parenchymatous degeneration, especially affecting the convoluted tubules. These changes occur whether the bitch is pregnant or not, but occur more rapidly in association with pregnancy. Further, such dieting commenced at the beginning of pregnancy causes the death of the foetus. Abortion in human beings may possibly sometimes be referable to an incomplete diet. In my opinion all the toxæmias of pregnancy are caused by toxins similar in all respects to those absorbed by every adult, and it is only the peculiar circumstances associated with pregnancy which allow of a sudden breakdown in the detoxicating functions of the liver and make eclampsia possible.

Treatment.—If this view is correct the elimination of eclampsia ought to be practicable and would depend on the provision of an adequate diet for pregnant women and on the avoidance of constipation. The diet needs to be easily assimilated and to contain all the vitamins, together with an abundant supply of calcium, iron, iodine, and sugar. Calcium can best be provided in milk and cheese, and can be given

in the form of calcium lactate in 5 gr. doses twice daily. If the woman is anæmic it is necessary to prescribe iron in one of its many forms, Bland's pills being a convenient preparation. Iodized table salt used in cooking as well as at table ensures an adequate supply of iodine. Meat should only be allowed once in the day, but a liberal supply of vegetables and fruit should be ordered. Finally it is imperative, especially in the North and in the manufacturing areas, to prescribe some preparation containing vitamins A and D. The following mixture: Bismuthi carbonatis, magnesi carbonatis (pond.), calci carbonatis (āā three ounces) given in drachm doses half an hour after meals and whenever necessary, relieves acidity, provides calcium, and acts as a mild laxative. It is very important that the woman should drink from two to three pints of water, hot or cold, each day, but it should not be taken within a half hour of taking food.

Seeing that the cause of the toxæmias is a damaged liver, startling results can hardly be expected from any line of treatment. The treatment suggested for an eclamptic patient is as follows: (1) The patient should be kept on her side, between blankets, in a dimly-lighted room. (2) A warm enema should be administered as soon as she is put to bed. (3) Fits and restlessness should be controlled by morphine and chloral hydrate. (4) The blood-pressure should be kept below 150 mm. Hg by injections of veratrine. (5) If the patient is able to swallow, adequate doses of *mistura sennæ composita* should be administered. Full doses of liver extract and irradiated ergosterol should also be given and the patient should be encouraged to drink as much fluid containing glucose as possible. (6) Calcium gluconate (up to 10 c.c. of a 10% solution) should be injected intravenously and repeated at four-hourly intervals so long as the patient remains comatose. Calcium gluconate provides no glucose, and is merely a convenient form in which to administer calcium. (7) Glucose should be given at four-hourly intervals, either intravenously or *per rectum*, the latter method being distinctly preferable. (8) No operative interference other than the application of the forceps to shorten the second stage should be considered. Should any operation become imperative it should be performed, if possible, under spinal anæsthesia.

As the patient improves, the amount of imperial drink should be increased to the maximum, and calcium, liver extract, and vitamin D should be given by mouth. Under no circumstances should any fluid be given by mouth to an unconscious woman, except through a stomach tube.

The same principles of treatment, not forgetting fluids and purgation, modified by the circumstances of the case, should be adopted when treating any of the toxæmias of pregnancy. Seeing that the renal symptoms are secondary, they require no special treatment, although a diuretic is sometimes of service after the patient has recovered from the attack of eclampsia. Similarly venesection is of little service except to relieve a failing right heart, or, if no veratrine is at hand, to lower the blood-pressure.

Note.—Since the date of reading this paper Professor J. Russell Greig, Director of the Animal Diseases Research Institute, Moredun, has sent me accounts of experiments he has carried out in association with Professor Henry Dryer and Dr. N. C. Wright, which prove that milk fever in cows is always associated with a marked hypocalcæmia. It was also found that the injection of fluid or air into the udder of an infected cow invariably raised the level of the blood-calcium, presumably by driving the calcium in the milk back into the blood-stream. Professor Greig has cured a number of cows simply by giving them intravenous and subcutaneous injections of calcium gluconate, and his results have been confirmed by several veterinary surgeons.

[June 20, 1930.]

A Case of Lithopædion. By H. K. GRIFFITH, F.R.C.S.

Mrs. C., aged 31, Russian by birth, has always been healthy. Nine years ago had a full time pregnancy. Child alive and well. No further history of pregnancy until:

December, 1928, last normal period. After that amenorrhœa.

January 16, 1929: The patient was seized with violent abdominal pain in the right iliac fossa. Admitted to University College Hospital. Next day all pain had disappeared and after a few days she was discharged with a diagnosis of "probable uterine pregnancy." Each subsequent month she had attacks of pain in the lower abdomen, never so severe as the one in January. She was conscious of a vague swelling in the right lower abdomen which did not appear to be like that of a normal pregnancy.

June, 1929: Severe uterine hæmorrhage, with abdominal pain; patient was supposed to have miscarried, but no foetus was seen, so far as the patient knows. Since then she has always been conscious of a swelling in the right side.

July, 1929: Menstruation recommenced and has been regular ever since.

February 24, 1930: Admitted to Torbay Hospital as a case of "fibroids." On examination: Breasts showed no activity. Abdomen: A hard, smooth, round swelling just to the right of the umbilicus, pushing up the abdominal wall and, passing from it, an irregular mass which extended into the right loin. There was dullness to percussion over the swelling but resonance elsewhere.

In the right side of the pelvis a smooth round tumour could be felt, independent of the other mass.

Bimanually, the lump in the pelvis could be felt to be about the size of a tangerine orange, and was apparently, in the right broad ligament, being attached to the uterus but movable from it, the uterus being displaced to the left. Urine normal; bowels opened with increasing difficulty.

A skiagram confirmed the diagnosis of a lithopædion, the hard mass just to the right of the umbilicus being the foetal head.

March 5, 1930: A right paramedian incision was made. The foetus was lying among coils of small intestine, the head being covered by great omentum. This was incised and the foetus was gently extracted, intestine mesentery and what appeared to be membranes being peeled off. The hole in the omentum was closed. The mass in the pelvis was then examined and found to be in the right Fallopian tube with the ovary above and the appendix adherent.

On separation of the adhesions, a raw surface was found on the posterior wall of the tumour which had evidently been the site of the rupture. The tube and ovary were removed together and the appendix separately. The wound was closed and the patient made an uneventful recovery.

A Case of Pregnancy in one horn of a bicornute uterus.—H. K. GRIFFITH, F.R.C.S.

Mrs. I. M., aged 33. Admitted to Torbay Hospital April 15, 1927 (under the late Dr. Thistle) on account of a prolonged pregnancy associated with ruptured membranes and the escape of liquor amnii and meconium during the preceding six weeks.

History.—Periods regular until April 23, 1926; since then there had been amenorrhœa which had thus lasted twelve months.

May 21, 1926: Morning sickness began, and continued for three months. August, 1926: Noticed enlargement of the abdomen.

September, 1926: Fœtal movements felt. A few days later there was some thrombosis in the left leg. After September there was frequency of micturition and

lack of control. For the last two or three weeks before admission there had been delay in beginning micturition. Bowels opened regularly with aperients.

March 2, 1927: Membranes ruptured, and meconium was noticed to be escaping soon afterwards. No labour pains had been felt. These dates were all confirmed by the patient's doctor. No history of any previous illness.

On Admission.—Temperature 98.2° F.; pulse, 108; respiration, 28. Breasts active. Abdomen enlarged by a tumour running from the right side of the pelvis up to the right costal margin, the left half of the abdomen being free of the tumour. The tumour was felt to be the uterus tightly enveloping the foetus, the head being in the upper pole, limbs to the left, the outline being easily palpated. No contractions could be felt. Foetal heart sounds—somewhat feeble—were heard at the level of the umbilicus on the right side. There appeared to be no liquor amnii.

Bimanually, the cervix was found to be high up and continuous with the abdominal tumour, the external os just admitting the tip of a finger, with meconium escaping from it. A rounded boggy swelling could be felt through the left lateral fornix filling up the left side of the pelvis, and apparently not continuous with the cervix. The urine contained a small amount of albumin.

A preliminary diagnosis of a post-mature foetus, possibly in a bicornute uterus, was made. As it was considered impossible for the child to be born alive, or even delivered at all, it was decided to open the abdomen.

Operation under chloroform anaesthesia. On opening the abdominal cavity the diagnosis was confirmed. The child was lying in one horn of the uterus, the wall of which was flabby. The other horn was the mass in the left side of the pelvis and contained several small fibroids. On opening the pregnant horn it was found that the child was adherent to the membranes from which it had to be peeled off. It was then delivered in a state of white asphyxia. The placenta and membranes were removed, and the uterine cavity was washed out with flavine. The uterine wall was closed with buried silk-worm-gut sutures and a continuous catgut suture in the peritoneum. I then removed the other horn and closed the abdomen.

The child responded to resuscitation after prolonged treatment. It was very emaciated, with the skin peeling and wrinkled, and it had long nails.

The patient was in a state of collapse for the first twelve hours, and had considerable distension and flatulence, but after that she began to make a good recovery. Five days later she complained of severe pain in the right axilla, and there were signs of pleurisy. An effusion formed and was tapped, a straw-coloured fluid being withdrawn containing mostly mononuclear leucocytes; no organisms were found.

May 19: The patient got up, and a few days later she had some pain in the left leg, but no oedema or tenderness. She was kept in bed for a week, after which she rapidly improved, and left the hospital on June 12.

The child did not improve during the first few days, and then began to gain weight.

The umbilical cord remained moist and showed no signs of separating; later it became septic. The child then began to lose ground, and died twenty days after birth.

The placenta was a partial "battledore" with calcareous areas present. Microscopic sections showed "evidence of atrophic changes in the tissue."

Sections from the second horn showed "the presence of masses of decidual cells, with marked degenerative signs."

Recurrent Melanotic Sarcoma of the Clitoris.—FRANCES IVENS-KNOWLES, C.B.E., M.S.

This specimen of recurrent melanotic sarcoma of the clitoris is of interest on account of the rarity of such tumours, and of its relatively slight malignancy, a period of six years having elapsed from the time the growth was first noticed by the patient to the present time when she is alive and well.

Very few cases of melanotic sarcoma of the clitoris have been recorded and in nearly all there is a history of very rapid recurrence, only one patient surviving as long as five years and a half after the primary operation.

When I showed the original specimen at a meeting of the North of England Obstetrical and Gynæcological Society in November, 1926, eighteen months after operation, I suggested as favourable points affecting prognosis, the absence of ulceration and fixation, the absence of enlarged inguinal glands, and the scanty pigmentation, which occurred only in patches. This good prognosis has been justified as I was not asked to see the patient again until December, 1929, when I removed an indurated mass the size of an egg from the left labium majus, adherent only at the site of the scar of the previous operation on the inner border of the tumour. Four days after operation a radium needle, 2 mgm., was inserted into the wound for 48 hours. Healing was satisfactory and the patient is now in excellent health.

Macroscopically, on section the fresh specimen presented a grey surface, more deeply pigmented areas being scattered through it.

Microscopically the growth is a spindle-celled sarcoma and shows scanty brown pigmentation very unevenly distributed.

Section of Otolaryngology.

SPECIAL SUMMER MEETING, JUNE 27 AND 28, 1930, HELD IN THE AURAL DEPARTMENT OF THE NOTTINGHAM GENERAL HOSPITAL.

Affections of Hearing and Adenoids: The Fight against Adenoidism in Italy.

By Professor GUIDO GUIDA.

THE great importance of adenoids in children as an ætiological factor in the origin of different diseases (catarrhal or purulent) of the ears, even up to complete deafness, has been for a long time known to the medical profession. Such knowledge should surely put us on our guard when we are confronted by a case of adenoids in which the patient begins to complain of diminished hearing.

Given the relation between adenoids and diseases of the ear, the first problem in Italy has been that of testing the frequency with which this phenomenon occurs. In fact, statistical data have been obtained in almost all the provinces. De Cigna has found affections of the ear in 40% of cases of adenoids; Leidi in 25%; Arslan in 59%; Lazzi 50%; I myself, in the region of Tuscany, in 42% (in 15% purulent otitis, and in 27% decrease of hearing); Manciola, in Rome, in 18%. My opinion, therefore, is that cases of adenoids may be divided into those in which there are also auricular lesions at the present time, those in which they have previously existed, and those in which they may still appear.

Considering the high percentage of auricular complications in patients suffering from adenoids, and the important influence of these conditions upon the physical and the mental development of the affected children, the Italian Government has been trying to find a remedy. In their struggle against the social plague of adenoidism and also with a prophylactic aim, the Italian Government has issued instructions to provincial authorities to organize special institutions for the treatment of adenoidism ("Istituti contro l'adenoidismo"), which are to work in co-operation with already existing hospitals and clinics, and in which children suffering from adenoids will be examined and treated by operation by specialists.

These specialists, after making a thorough examination of the children at schools, send cases of adenoids and deafness or impaired hearing to the Institute, where they are operated on, and treated with inhalations of calcium and iodine for several days. Each child is provided with a card, on which his name is inscribed, together with the authorization of the parents for the treatment, and, later, the clinical notes of the case.

Children in the schools should be carefully examined, not only by the school medical officer, but also by specialists, as to the condition of the ears and nasopharynx. It is surely not advisable to neglect these otopathic children when an amendment of their hearing faculties would render them capable of becoming useful and intelligent members of society, and therefore Italy, under its present Government, has faced a vital question by forming a powerful central organization, working in co-operation with similar organizations all over the country, towards solving the biological and ethical problems of childhood and thus ameliorating the physical condition of the race, and raising it to higher moral levels.

Discussion.—Mr. SYDNEY SCOTT said he must congratulate the Italian Government on insisting that the operations in the clinics should be performed only by competent specialists.

Mr. H. BELL TAWSE said that a committee, of which he was a member, had been appointed by the Board of Education six years before "to inquire into the incidence of—and physical and environmental conditions associated with—enlarged tonsils and adenoids, and into the methods and results of treatment." An interim report had been published in 1929.

The investigations were carried out in children of school age, many of whom had already passed the usual age of onset. It was therefore decided to proceed with a further investigation in younger children, utilizing the infant Welfare Centres for that purpose.

During the last eighteen months he had been trying the effect on children who were about to undergo operation for tonsils and adenoids, of preliminary administration of sodium bicarbonate until the urine was alkaline, as suggested by Mr. Lowndes Yates.

He was satisfied that since the adoption of this plan there had been much less post-operative hemorrhage from enucleation by the guillotine method. He had not been able to convince himself that the immediate loss of blood had been reduced.

There was no age limit. The operation should be carried out—irrespective of age—if the child showed symptoms detrimental to health and hearing.

Mr. L. GRAHAM BROWN said that he had been impressed with the fact that more and more children were coming up for operations at a younger age. A few years before the late War the children coming for these operations were from 14 to 16 years old, though there were younger children too, but nowadays one had them coming as early as 3, 4 and 5 years of age. He operated in this way on about forty in a week, and the majority were from 3 to 8 years old. This showed that the authorities who dealt with these matters were alive to the association of adenoids with deafness, and the result of greater care in this matter was an all-round improvement, not only in the general health of the children, but in hearing capacity. Therefore he considered it of great importance nationally, as well as to the individual, that obstructive adenoids and adenoids producing symptoms of deafness should be recognized and operated upon early. It had been said that adenoids should not be operated upon at an earlier age than 3 years, but he did not subscribe to that opinion; he thought they should be removed as soon as indications pointed to the need. In other words, if hearing was defective, whatever the age of the child, adenoids, if present, should be removed.

Another point which had occurred to him was that since laryngologists saw a fair number of children returning for the adenoid operation, the question might be raised why these children should be sent to clinics for repeated adenoid operations. He thought it was because a considerable number of these children were again recommended to the clinic on account of nasal catarrh, and therefore medical officers, possibly inexperienced, concluded without proper investigation that adenoids were again present. In such cases, after the first removal of tonsils and adenoids, the child should be put into the hands of a competent ear-nose-and-throat surgeon, who could diagnose the condition correctly, and so save the child from an unnecessary further operation. Frequently in such cases no adenoids were to be found, but there was a purely intranasal condition, possibly maxillary suppuration.

Mr. HAMBLÉN THOMAS said he had examined a considerable number of infants. The Board of Education desired to have infants examined at the earliest possible age, and were trying to ascertain the cause of adenoids. The children should be examined over a period of five years; at first a fair number attended for examination, but towards the end of the five years' period the number dwindled to one or two, so that there was a real difficulty in arriving at a percentage.

So far he (the speaker) had been unable to point to any particular cause of the adenoids in these children, though the dietetic factor was an important one: in breast-feeding the mothers might not be receiving the right sort of diet, and they might not be in a fit state of health. If possible, children should be examined before they arrived at school age. In the usual way they began to attend school at the age of 5 years, and then they came under regular medical examination, but often by that time the damage was done. In many cases the child had not any medical attention before going to school.

Mr. LOWNDES YATES said that the development of the nasal sinuses after birth was a subject of great importance in the question of the formation of adenoids. Just before the age of 5 years the permanent teeth passed into their adult position; the antrum enlarged, the ethmoids began to increase, and shortly afterwards they pushed the middle turbinate into the nasal airway. Until then, if a child inhaled a white powder it would pass through the nose into the nasopharynx, because the nasal mechanism for the removal of dust and bacteria hardly existed before this age. He (the speaker) thought that adenoids were the infantile mechanism for the removal of dust from the inspired air, and that to take them away too early in cases in which there were no respiratory or aural symptoms and no enlarged

glands in the neck, was to deprive the child unnecessarily of this method of protection of the lungs against inhaled infection. After 5 years of age the adult mechanism for the removal of dust and organisms began to function, and it became, during the ensuing years of childhood, more functionally complete, until at length it replaced the infantile mechanism.

He had investigated cases in which the child was subjected to a highly infective environment, as when the mother had a high degree of pyorrhœa or ozæna. In such a case adenoids were formed very early, and as they became large they had to be removed during the early stages of infancy if the mother's infective condition was not cleared up. If the infective condition of the mother was cured, the child's adenoids generally diminished in size. The results of the investigation seemed to point to the conclusion that the excess of lymphoid tissue in these children was the result of sepsis, and that it was the septic material floating about in the air, coupled with food deficiencies and other factors, which caused enlarged tonsils and adenoids.

Mr. THACKER NEVILLE asked what instruments Professor Guida used for removing adenoids in Italy. He (the speaker) thought the Laforce guillotine, or adenotome, was best for removing adenoids from behind the openings of the Eustachian tubes, and for preventing subsequent tags. The instrument had blades of three sizes, and so could fit the smallest naso-pharynx.

In this country there was a system for examining children who had septic tonsils and adenoids, and in the industrial towns these were removed by specialists. The counties of England were spending a good deal of money on this work; but there was as yet no means of examining the hearing of children in the mass. Was there a system in Italy, as in America, for simultaneously examining the hearing of large numbers of school children with an audiometer?

Mr. HUGH E. JONES said that, in his opinion, a great number of very young children sent by the school authorities for operation, did not require one. That was probably because they had not been examined by experts, or even by doctors, but by a school-mistress or an assistant-master. When the child came to hospital the surgeon looked down the mouth in a casual way, and thinking that the child had not been sent without good reason, operated. Examinations in schools should be carried out by competent persons.

A further point he would like to make was that children under school age were operated upon with too large an instrument. He had had a much smaller guillotine made for these cases. Frequently he found that children had sustained a slight tearing at the junction of the pillars. A smaller instrument would deal with even large tonsils.

Certainly adenoids should be dealt with early, but those in children under 2 years of age could not be operated upon with advantage unless they showed obvious interference with breathing.

Mr. T. B. LAYTON said it was necessary to go still further back and agree on what was meant by "adenoids," as it seemed clear that Mr. Graham Brown and Mr. Hamblen Thomas had a different idea on the matter from that of Mr. Lowndes Yates. The two former speakers seemed to look upon adenoids as a pathological condition which should be removed early in life, whereas Mr. Lowndes Yates looked upon them as a physiological structure, which, in early life ought, as far as possible, to be conserved. He (Mr. Layton) was on the side of Mr. Yates. As to the age at which adenoids should be removed, he found himself making it later and later. He did not think Mr. Graham Brown should really be proud of operating upon children at the age of 3 years; it must only be very occasionally that operation was needed at that age.

Again, it was necessary to decide whether there were such things as "septic adenoids." To him (the speaker) the term was meaningless; adenoids indicated simply a hypertrophy of a normal structure; it became pathological only when they were sufficiently large to obstruct either the posterior nares or the Eustachian tube, or both. He therefore found himself practising two separate operations on adenoids, according as to whether the indication was nasal or aural. If it was aural, he removed the lymphoid tissue round the Eustachian tube, particularly from Rosenmüller's fossa. He left the lymphoid tissue in the mid-line. In young children one could not get rid entirely of the lymphoid tissue in the nasopharynx; nature needed it there. If the lymphoid tissue in the mid-line were taken away it hypertrophied all the more laterally round the Eustachian tube, often making the child, from the aural point of view, worse than he was before, and thereafter it was difficult to do anything for him.

Lymphoid tissue was present to a greater extent in children who were constantly combating a larger number of micro-organisms than they should normally encounter; consequently a child living under bad hygienic conditions needed all its lymphoid tissue, and therefore in the case of children living in overcrowded slums, the operation should not be performed. In every case he inquired of the parents what the home accommodation was, and if he found that there was overcrowding, he refrained from operating. Of course these children needed treatment, and this must include, if possible, better living conditions.

Mr. HAMBLEN THOMAS said he did not mean that children under the age of 5 years should have adenoids removed as a general rule; he meant that they should not be allowed to continue with large adenoids in their post-nasal space, causing deafness for two or three years, and then not come under adequate inspection and treatment until they arrived at school age. If children required treatment, this should not be postponed until school age. Adenoids were found in the children of the highest in the land, therefore the question was not altogether a matter of surroundings.

Mr. HAROLD KISCH said that Mr. Lowndes Yates had presented his point very ably, but he (the speaker) did not think that infection was altogether the cause of adenoids and enlarged tonsils. In India he had been in contact with a European colony who were living 5,000 feet above sea level, and the children there had had an adequate supply of good milk and food and were well looked after, yet all had very large tonsils and masses of adenoids; he had operated upon the whole colony. There seemed no reason for the condition unless it were the altitude.

With regard to septic adenoids: on two occasions he had removed a pad of adenoids, inside which there was an abscess, therefore he was sure that there was such a condition as a septic adenoid. He had seen many cases in which pus had oozed out of adenoid tissue. A considerable number of cases of enlarged glands in the neck were due to septic adenoids, and not necessarily to septic tonsils at all. In many cases he had seen glandular masses disappear after septic adenoids were removed, the tonsils not having been touched. He thought that septic adenoids caused enlarged glands in the neck.

After children had undergone operations on account of defects in hearing, they should be kept under observation; as a rule, no more trouble was taken in regard to treating the hearing. He had had numbers of cases of children whom he had treated for years by inflation, thus getting their hearing back to normal. One child, aged 4, had been brought to the hospital as a deaf-mute. She had adenoids and enlarged tonsils, which were removed, and he (Mr. Kisch) trained her to allow him to do Eustachian inflation. She was brought up regularly for five years for treatment by inflation, and she now had perfect hearing. A fortnight ago her mother had brought her to him to show how well she had progressed.

He had discarded the Laforce guillotine twenty years ago; he considered that Sir StClair Thomson's curette, used as a cutting instrument, was better. In nearly all the cases of hæmorrhage after adenoid operations, a Laforce instrument had been used.

Mr. C. A. S. RIDOUT, referring to sinus infection after recurrent adenoids, said that in many cases this was nothing but nasal sepsis, and that was a reason why these operations should be performed by competent laryngologists, as many cases of maxillary sinusitis were missed by the ordinary practitioner when operating on adenoids. The child, not receiving benefit, was sent for another operation, which, perhaps, was carried out with equal vigour to that employed before. Possibly even a third operation was performed, and then it transpired that the trouble was due to sinus infection.

He thought that many cases of adenoids were being operated upon too early; if one waited, one found that the adenoids disappeared in the course of a few years as the sinuses developed.

Mr. BROUGHTON BARNES thought people should not be given the impression that many laryngologists were meeting these cases for the first time when they were on the operating table. If children were operated upon unnecessarily that was the fault of the operator.

Mr. Layton said he was leaving cases later and later before he operated, and that he now did not operate if the patients were in bad environment. Doubtless Mr. Layton dogmatized in that way in order to make his hearers listen. If there was a muco-purulent discharge from the ears and at the same time a mass of adenoids, whatever the age of the patient, he (the speaker) did not believe that Mr. Layton would leave the adenoids untouched.

Mr. WATKYN-THOMAS said that in a number of cases of so-called "recurrent adenoids" one could see a felted mass of sodden mucosa extending right across the nasopharynx from one anterior pillar to the other; such a condition was frequently associated with nasal sepsis.

He did not believe that it was justifiable to leave adenoids in the presence of a chronic suppurating ear.

He had seen a true abscess cavity in an adenoid pad, and had often expressed pus from a pad.

Professor GUIDO GUIDA (in reply) said that it was the custom in Italy to test the children's hearing power before performing the operation, and sometimes before the operation the children were sent to have inhalation of calcium or iodine; for the latter a special iodine-containing water from Salso Maggiore was used. Many school children were seated in a room into which steam was introduced from a boiling kettle containing this substance and they remained for some time inhaling the vapour. The hearing of the children was tested individually, not *en masse*.

They were not usually operated upon in Italy before three years of age.

He (the speaker) used the ordinary curette, as did his colleagues.

The Swim-bladder and Weberian Ossicles and their Relation to Hearing in Fishes.

By H. MUIR EVANS, M.D.

ONE cannot do better than open this discourse with a quotation from the "Compleat Angler," by that master of prose and master-fisherman, Isaac Walton:—

"V.: But, Master, do not trouts see us by night?

"P.: Yes, and hear and smell too, both then and in the day time: and that it may be true seems to be affirmed by Sir Francis Bacon, who there proves that water may be the medium of sounds. This has made me believe that eels unbed themselves and stir at the noise of thunder. And this reason of Sir F. Bacon's has made me crave pardon of one that I laughed at, for affirming that he knew Carps that came to a certain place in a pond to be fed at the ringing of a bell or the beating of a drum; and, however, it shall be a rule for me to make as little noise as I can when I am fishing, until Sir Francis Bacon be refuted, which I shall give any man leave to do.

"All the further use I shall make of this shall be to advise anglers to be patient and forbear swearing lest they be heard and catch no fish."

We are indebted to G. H. Parker for an exhaustive critical survey of the sense of hearing in fishes (*Proc. American Phil. Soc.*, 1918). In discussing the question of "Hearing in Fishes," it is well to define what is meant by the term; for the purpose of this paper I will adopt Parker's definition and quote his words:—

"The test for hearing in fishes is the proved presence of a response mediated by the ear, and dependent upon some vibratory physical disturbance in the water, which disturbance may vary from the extreme regularity of a pure tone to the extreme irregularity of a noise, such as a report of a gun or other like explosion."

The subject can be approached from three angles: (1) From the point of comparative anatomy. (2) From a purely anatomical standpoint. (3) By the methods of experimental biology.

"Certain Teleostean families like the Siluridæ, Sciaenidæ and Triglidæ seem distinguished above all others by the prevalence of some form of vocal organ" and use the air-bladder as a sound-producing organ. The Sciaenidæ is a large family with about 150 species. The "maigre" or meagre (*Sciaena aquila*) is common in the Mediterranean and is sometimes taken on our coasts. It is supposed to have given rise to the legend of the sirens. H. M. Smith, in 1905, made observations

on the drumming among *Sciaenidae*. He found that in those fish that drum the otoliths of the sacculi were exceptionally large, whereas in *Menticirrhus*, a sciaenid which does not drum, they are relatively small. He came to the conclusion that the sacculus had to do with hearing and the utricle with equilibration.

Parker, in 1903, described the deep drumming sound produced by the squeteague, *Cynoscion*, which is audible when the fish is in the air at a distance of fifty feet. This sound is produced only by the males, and it results from vibrations produced by a special muscle on the abdominal organs and particularly on the swim-bladder. The females not only do not drum, but possess no special muscle. It must be allowed that unisexual sound production strongly suggests the power of hearing.

This observation and those of Smith on the otoliths of *Menticirrhus* therefore strongly supports the view that fish can hear. That fish can hear was the opinion of Casserius, 1610, Hunter, 1782, Cuvier, 1805, and E. H. Weber, 1830. Hunter described an experiment of a response by movement to the discharge of a gun when this was fired behind shrubs. Weber described the ossicles which bear his name and called them after the auditory ossicles of human anatomy.

It is often stated that a fish cannot hear because it has no external ear and no organ of Corti.

The first point is readily answered by a consideration of the difference in the media in which air-breathing and aquatic animals exist. Vibrations in the air require a drum for the reception of sounds, although this does not seem always necessary when one considers that in disease in which the membrana tympani is partially or completely lost, there may be very little diminution in the appreciation of sounds. In fish vibrations are received through a very different medium, and they are communicated directly through the body walls. One may, therefore, consider that the hearing in fish is analogous to what aurists call bone conduction, vibrations carried directly to the saccules through the bony walls of the fish.

It is possible that in those fish with swim-bladders and Weberian ossicles, vibrations are carried through the body walls to the air in the anterior sac, which acts as a drum, and that these vibrations are conveyed to the sacculi by means of the Weberian ossicles.

As is well known, through the work of Retzius, a typical fish has an internal ear, with a utricle, and three semicircular canals, a sacculus, with a large macula, on which rests the sagitta, and another macula in a specialized area called the lagena. This is generally held to represent that part of the internal ear which, in air-breathing animals, develops into the organ of Corti. It is interesting in this connection to compare the internal ear of the frog with that of a fish. One of the marvels of biology is the metamorphosis of the tadpole, in which the disappearance of the lateral line organs is dramatic in its suddenness and their replacement by an auditory organ is equally abrupt.

The picture of the internal ear of a frog differs very little from that of a fish. There is a ductus endolymphaticus, a utriculus with anterior, posterior and lateral semicircular canals, a sacculus with a lagena and two smaller papillae, *P. neglecta* and *P. basilaris*.

There is nothing in the nature of an organ of Corti, and yet no one is prepared to admit that frogs do not hear. It may be interesting to give a résumé at this point of what is known of hearing in frogs.

Yerkes (1905) observed frogs in their natural habitat and found that they were stimulated by sounds:

"The sense of hearing apparently serves rather as a warning sense which modifies reactions to other simultaneous or succeeding stimuli, than as a control for definite auditory motor reactions. Experimental tests prove that sounds modify the frog's reactions to visual and tactile stimuli. When the sound accompanies the visual or tactile stimulus it reinforces the visual or tactile reaction but when given alone it never causes a motor reaction."

"Sounds modify the reaction of a frog after tympana and columella are removed. Cutting of the eighth cranial nerve causes a disappearance of the influence of sounds. It is clear then that the reactions to sounds are really auditory reactions, and that the sense of hearing in frogs is fairly well developed, although there is little evidence of such a sense in the motor reactions of the animal."

The Ostariophysi is a collective name for four families: Cyprinidæ, Siluridæ, Characinidæ and Gymnotidæ, in all of which the auditory organ has an intimate connection with the swim-bladder by means of a series of movably-connected "Weberian" ossicles of which the posterior, the tripus, is inserted into the dorsal wall of the swim-bladder ("Cambridge Natural History," vol. "Fishes"). According to Günther, out of 2,269 species of true freshwater fishes, the above four families account for 1,577 species. It is a significant fact that the Weberian mechanism is characteristic of the dominant families of the freshwater teleosts at the present day. The Cyprinidæ include the carps, roach, rudd, bream, and most of our coarse fish.

In a typical cyprinoid fish the swim-bladder is large and lies free in the abdominal cavity. It is constricted in the middle to form an anterior and posterior chamber, the latter more frequently the larger. It is joined to the œsophagus by a pneumatic duct which opens near its constricted region. The anterior end of the anterior chamber is attached to the posterior extremity of the tripus on either side:

The posterior sac of a roach is elongated and somewhat pear-shaped, with its apex projecting backwards. The base is connected with a small short duct, the ductus communicans, with the anterior sac which is roughly oval in shape and has about one-third the capacity of the posterior.

Below this duct in the posterior sac is another orifice leading into the pneumatic duct which communicates with the œsophagus. The walls of the posterior sac consist of a thin layer of involuntary muscle fibres which is reinforced by two strong lateral bands running longitudinally with a slight spiral twist from the base to the apex where they meet. These bands are continuous at their base with the fibres of a sphincter surrounding the ductus communicans. This sphincter extends downwards and is connected with another sphincter surrounding the orifice of the pneumatic duct. Exterior to the muscular coat of the posterior sac is a vascular layer; a large artery and vein pass along the line of the longitudinal muscle and divide up into smaller vessels which branch off laterally, each artery being accompanied by a vein, and finally fan-shaped arrangements of vessels extend over the whole wall and communicate with the vessels from the opposite side by a fine system of capillaries. From these capillaries a few vessels appear to pass through the muscular coat and communicate with a fine capillary network lying beneath the internal epithelial lining of the sac.

There is no red body or rete mirabile in cyprinoids, but I have observed small areas of the epithelial lining in the gudgeon showing two or three layers of epithelium, through which the small capillaries are seen to course.

The walls of the anterior sac are very differently constituted. In the first place, there is a very strong external coat, superficial to the muscular coat. It is composed of strong fibrous tissue in which the fibres have a criss-cross arrangement and are arranged in several layers. The external coat is attached anteriorly to the apex of a central bony plate which descends from the vertebral column in order to support the swim-bladder. Posteriorly it allows the ductus communicans, which is continuous with the muscular coat, to pass through a circular aperture in its coat.

If a circular cut be made near the posterior end of the external coat, the muscular coat and its contained gases can be removed *en bloc*; it will then be seen that the external coat has a slit or hiatus on its superior aspect, leaving two free edges which pass backwards and downwards from the base of the central plate. This free area is filled posteriorly with a soft tissue which seems to be similar to the membrana

flaccida of the human membrana tympani. Immediately posterior to the base of the central plate will be seen on either side the posterior end of the tripus, from which, for the space of a few millimetres, fibres of the external coat spring. But from the actual tip of the tripus there springs a small muscle, which I propose to call the tensor tripodis.

This muscle is triangular in shape and is inserted by its apex into either side of a hollow, the fovea centralis, at the base of the central plate. That portion of the free margin of the external coat anterior to the tripodal attachment is attached to the tip of the central plate and runs therefore downwards in a more or less vertical direction, while the portion of the free margin posterior to the tripodal attachment runs in a longitudinal direction backwards.

It will be obvious if one looks at a specimen, how well adapted this arrangement is for the movement of the tripus, when the walls of the anterior sac are set into vibration. Where the slit or hiatus ends posteriorly, there is a central ligament which passes forwards to be attached to the vertebral column.

The attachments, therefore, of the anterior sac are firstly, to the tip of the central plate, then indirectly, by the tensor tripodis, to the base of the central plate at its lateral margins, and finally, by the central ligament, to a vertebral centrum.

The muscular coat consists of a thick sphincter which surrounds the posterior end and is continuous with the ductus communicans, and inferiorly is prolonged forwards as a broad band which bifurcates and then ends in two blind extremities, in the neighbourhood of the tripus.

The anterior sac also differs from the posterior by presenting no fan-like arrangement of capillaries or parallel branchings of arteries and veins.

The ductus communicans is not simply a duct guarded by two sphincters, one in the posterior and one in the anterior sac. It is the seat of a very complex nerve ganglion. This ganglion is supplied by the vagus, which gives off a large branch to the swim-bladder. This branch divides shortly before entering the substance of the bladder: one division ramifies round the sphincter which guards the pneumatic duct, and the other passes to the ductus communicans.

In addition to all this complex structure of what at first sight would appear to be two membranous bags filled with gas, we have to describe another complicated organ, namely, the pneumatic duct.

The pneumatic duct is a fine tube with muscular walls; as it nears the œsophagus it becomes gradually enlarged and forms what we propose to call the pneumatic bulb. Here the duct enlarges and in some fish divides up into a number of canaliculi, which finally enter an enlarged portion leading through a narrow orifice into the œsophagus.

This orifice is guarded by a strong sphincter, which is controlled by a special ganglion innervated by the vagus. In the pneumatic bulb are also a number of diverticuli which run parallel to the duct; the function of these is obscure.

An important observation has been made by Damant and myself, namely, the presence round the orifice of the pneumatic duct of a large number of taste-buds. When the fact is recalled that these fish swallow air and pump it by the pneumatic bulb into the swim-bladder, the significance of sense organs in this position is apparent.

The Weberian ossicles are four in number, named the tripus, inter-calarium, scaphoid and claustrum.

The tripus or malleus, to use Weber's original nomenclature, is crescentic in shape, with a projection in its concavity which articulates with a vertebral centrum by means of a wedge-shaped portion lying at right angles to the long diameter of the crescent. The posterior horn of the tripus is prolonged by a very fine spicule which winds round the base of the central plate, and from which arise the anterior fibres of the external coat of the anterior sac, while to its extreme tip, anteriorly, is

attached the base of the pyramidal or triangular muscle, the tensor tripodis, above described.

The anterior horn of the crescent is prolonged by the inter-ossicular ligament which attaches it to a small bone, the scaphoid, and this again joins up with a circular scale-like bone, the claustrum, which forms the outer wall of the sinus impar. The interossicular ligament is supported in its centre by the inter-calarium, a small triangular ossicle the base of which rests on a vertebral centrum in front of the tripodal articulation, and is capable of executing to-and-fro movements in an oblique direction, similar to those of the tripus. The main body of the crescent of the tripus runs in a direction of about 60° upwards and forwards from the base of the central plate.

The Connection of the Ossicles with the Internal Ear. The "Cambridge Natural History" volume on "Fishes" describes this as follows:—

"The anterior ossicle (scaphium) forms the outer wall of a median backward prolongation (sinus impar) of the perilymph-containing spaces surrounding the two auditory organs. This in turn encloses a similar median prolongation (sinus endolymphaticus) from the two sub-cerebrally united endolymphatic ducts."

Bridge and Haddon made an important observation, which strongly favours the view that the Weberian ossicles are in connection with the sacculi and lagenæ. They state "there can be but little doubt that the sensory epithelium of the two sacculi is solely concerned in the transmission of stimuli received through the Weberian mechanism to the eighth nerve; for the oblique valve in the ductus sacculo-utricularis must prevent the extension of any disturbance in the endolymph of the sacculi to the utricle or to the semicircular canals and their ampullæ."

The relative size of the anterior and posterior sac of the swim-bladder has an important bearing on its function. The swim-bladder is supposed to be a hydrostatic organ, and its size and extent in cyprinoids are directly correlated with this function.

Dr. Hora has pointed out that in those cyprinoid genera which live in rapidly running waters and consequently lead a ground habit of life, the bladder undergoes considerable degeneration: there is a gradual reduction of the two chambers and the posterior ultimately disappears.

The hydrostatic function of the posterior sac has been recently proved by a large series of experiments by Damant and myself. If several goldfish or roach are confined in a bell-jar full of water with a large bubble of air trapped in its top, and a current of water allowed to pass in from below and out by means of a tube at the top, and if this tube is attached to a container that can be raised to 8 or 9 feet or lowered at will, the fish without any manipulation can be subjected to the pressure they live in normally, or be subjected to a pressure of several feet of water at will.

If the pressure is raised, by raising the container, the fish at once sink to the bottom because their normal neutral buoyancy has become negative buoyancy, owing to the increased pressure acting through the compressible body-wall on the gases in the swim-bladder having produced an increase of its specific gravity. The fish almost immediately show signs of discomfort and become restless; they then start swimming upwards, and with each cessation of activity sink to the bottom; after one or two attempts they come up to the surface and suck air from the trapped bubble; they then go down again and shortly repeat the process. After a few of these excursions to the surface the container is lowered and the pressure becomes normal; it is then noticed that the fish have to swim downwards to prevent themselves from floating to the surface, and the mysterious upward lift of the fish when they cease active swimming is very striking.

A condition has been obtained of marked positive buoyancy, and this can be rendered neutral again if time is given to the fish to discharge gas from their pneumatic tube.

This experiment can be modified. If several c.c. of gas are removed from the swim-bladder of a roach and the fish is prevented from coming to the surface by a wire netting, compensation only takes place after a period of from two to four days, and in some cases much longer time is required. If the contained gases are examined in fish that have rapidly regained their neutral buoyancy by swallowing air, the analysis shows oxygen 8.9%, carbon dioxide 3.4%, whereas a normal fish has on an average oxygen 6%, carbon dioxide 2.8%. On the other hand, an analysis of the gases in a fish which has compensated without access to the surface gives oxygen 25.7%, carbon dioxide 3.4%.

Bridge and Haddon in their important monograph on the Weberian ossicles hold that the posterior sac, being larger than the anterior, acts as a sort of barometer and enables the fish through the medium of the Weberian ossicles to estimate its depth in the water. The above experiments and the comparative anatomy of the swim-bladder effectually dispel the accuracy of this supposition.

The question now arises, if the swim-bladder is primarily hydrostatic in function, what is the value to the animal, of a divided sac, with each sac controlled by a sphincter on either side of a ductus communicans in which is situated an elaborate nerve ganglion? Further, we have to inquire into the function of the chain of ossicles. It must be mentioned that the swim-bladder of cyprinoids is a high-pressure swim-bladder. A roach living normally in but a few feet of water, has an average pressure in each sac of about 60 mm. Hg or $2\frac{3}{4}$ ft. of water pressure. Experiments suggest that the pressure in the swim-bladder, if the intrinsic muscles have lost their normal tone, is somewhere about 30 mm. Hg, and that the intrinsic muscles raise the pressure normally to 60 mm., but when necessary, by their contraction, can raise the pressure to 90 mm. Hg, and even to 120 or more mm. Hg. Experiments also tend to prove that the sphincters are normally in a state of contraction, and only relax under certain conditions; they can remain closed with a positive pressure of 56 mm. Hg in one sac, while there is but a few mm. pressure in the other; in fact one sac has been laid open experimentally, while the other sac remained quite tense with a pressure of 50 mm. Hg.

Our view of the mechanism can be summarized as follows: Air gulped by the fish is directed by the taste-buds at the œsophageal orifice of the pneumatic duct into the pneumatic bulb, and is thence pumped into the posterior sac. The pressure in this sac is kept at an average of 60 mm. Hg by the intrinsic muscles; the ganglion in the ductus communicans controls the pressure in either sac, and is the special guardian of the pressure in the anterior sac; it allows relaxation of the sphincters when necessary, and governs the intrinsic muscles of both sacs. In fact the ductus communicans functions as a Eustachian tube, and controls the air pressure within the anterior sac thus allowing it to vibrate.

The vibrations of the external coat of the anterior sac are communicated to the tripus and thence by the chain of ossicles to the sinus impar and so to the sacculus, the ossicles being kept tense by the special muscle, the tensor tripodis.

Sörensen, whose views we uphold, came to the following conclusions:—

(i) The wall of the swim-bladder is capable of vibrating synchronously with rapidly recurring sound waves.

(ii) The tripus is thrown into vibrations when the wall of the bladder is vibrating.

(iii) All movements, also vibrations of the malleus, are transmitted by means of the tight interossicular ligaments to the rest of the ossicles, and in this way to the atrium sinus imparis.

(iv) The tones of the air-bladder can be transmitted to the water without losing much strength, and, if so, *vice versa*, sound waves can be transmitted from without to the air-bladder.

Hearing in Fish in the Light of Experimental Biology.—Goldfish and other fresh-water fish kept in ponds have been (it is stated) in the habit of assembling for food at the sound of a bell. Kreidl was of opinion, as the result of his experiments,

that a goldfish made no response to sounds produced in air or in the water, but only reacted, as Bateson found, to the shock of a blow given to the sides or top of the aquarium. Bateson removed the auditory nerves and the attached ear sacs, and found that the fish reacted to the shocks in the same way as uninjured fish do.

Kreidl, Bateson and Lee all agreed that these observations of assembly of fish were to be explained by the sense of sight and the sense organs of the skin.

Bigelow, at Parker's suggestion, repeated Kreidl's experiments. He used as a source of sound a tuning-fork vibrating 100 times per second, and used precautions to eliminate all shocks or disturbances in the experiments. He found that fish responded to the sound by characteristic movements, and gave the same response even after one auditory nerve had been cut; if both nerves were cut the response disappeared.

Kreidl's experiments were severely criticized by Bigelow. He showed that the removal of the auditory nerve and ear sacs that Kreidl described was not in fact possible, as the sacculus and lagena cannot be removed by extracting the semicircular canals.

G. H. Parker, working with van Hensen, made some elaborate experiments. It was found that the skin was a receptor for vibrations of low frequency. When the ears were alone functional, vibrations of an order of 344 and 688 were accompanied by a response. It was also found that currents of water, and water dropped on to the surface of the aquarium, were only able to stimulate the skin.

We now come to the results described in a recent paper by F. B. Manning (1924), on the sense of hearing in goldfish. In this paper we get definite evidence of the functional use of the swim-bladder and Weberian ossicles, as experiments were devised in which only the lagena and sacculus were functional; as we have already seen, the sacculus alone receives vibrations conveyed by the Weberian ossicles from the anterior sac.

Manning experimented by means of a submerged telephone, capable of producing vibrations of from 43 to 2,752 per second on: (i) normal fish; (ii) on fish in which the utriculus was destroyed, and (iii) on fish in which the lagena and sacculus were destroyed.

He concluded that the receptor systems for sound vibrations were three in number: (1) Skin, normally up to 344 vibrations per second. (2) The lateral line system, with perhaps the same frequencies as the skin. (3) The ear consisting of the utriculus, with a range up to 688, and of a sacculus and lagena, with a range from 1,376 to an undetermined frequency above 2,752 vibrations.

The Weberian ossicles, therefore, appear to constitute an organ evolved for the detection of vibrations of a high frequency.

H. O. Bull has described experiments on conditioned responses in fishes in recent papers in the *Journal of the Marine Biological Association*, 1928-30.

The method of experimentation was the production of an associated response to food dropped into a bottle which the fish had to enter, and the vibratory stimulus of a tuning-fork or buzzer. Elaborate precautions were taken to prevent any stimuli of light, vision or noise interfering with the result. With a wrasse, conditioned responses were formed towards vibratory stimuli, using a tuning-fork of 128 d.v.'s per second, and food as an unconditioned stimulus. A conditioned response has been formed in the common eel, *Anguilla vulgaris*, towards the vibrations of an electric buzzer, using an electric shock as an unconditioned stimulus, by the same observer.

SUMMARY.

In Cyprinidæ the two-lobed swim-bladder has been shown to possess two functions. The posterior sac hydrostatic, the anterior sac a receptor for vibrations. The anterior sac has been shown by Sørensen to vibrate, and the tripus to vibrate with it.

- (a) The sinus impar records vibrations which can only reach the sacculi.
- (b) The series of ossicles are kept tense by a special muscle, the tensor tripodis.
- (c) The external coat of the anterior sac has a structure similar to that of a vibrating membrane.
- (d) The tip of the tripus is inserted in the middle of a free margin of the external coat, which is formed by a longitudinal hiatus in its superior wall.
- (e) The posterior sac can be replenished by swallowed air. The pressure in the two sacs is controlled by the vagus acting in connection with a specialized ganglion in the ductus communicans; this latter acts as a Eustachian tube.

In the face of this cumulative evidence of an auditory function for the Weberian ossicles, we are compelled to go back to the views of Weber, and acknowledge that he had a sounder physiological vision than some of his more enlightened successors.

Discussion.—MR. LOWNDES YATES said that in a paper, in *Science Progress*, published in 1900, Dr. Albert Gray had dealt with another aspect of this subject namely, the development of the perilymphatic sacs in carps and herrings, and had shown the extreme complexity of these sacs as they made junction with the air vesicles of the fish. Dr. Gray had pointed out that many of the further steps in man were represented in fishes.

MR. ALEXANDER TWEEDIE said he would be glad if the lecturer could say something about innervation in connection with the swim-bladder and its relation to the eighth nerve. A Russian investigator had been making some experiments on the subject,¹ which consisted in centrifugalization and consequent destruction of the otolithic apparatus, but with the semicircular canals and muscular control of the fins left intact. Thereafter the fish were subjected to a pressure of five or six atmospheres, whilst other normal fish were placed in the same vessel as a control. The air pressure was then suddenly reduced, with the result that the normal fish at once regained their power of rising, while those which were centrifugalized remained inert.

DR. MUIR EVANS (in reply) said he did not know the details of the innervation. At present he was working through a series of brain sections to study the comparative anatomy of the acoustico-lateral area in several members of the Cyprinidae.

(The concluding report of this meeting will be published in the next issue of the *Proceedings*.)

¹ "Bericht über die neueren russischen Arbeiten über Physiologie und Klinik des inneren Ohres," by S. Kompanejetz, *Otolaryngologia Slavica*, i, fasc. 2, 215.

Section of Urology.

[June 26, 1930.]

The Treatment of Vesical Papillomata by Cystoscopic Diathermy.

By J. SWIFT JOLY, F.R.C.S.

IT is now twenty years since Edwin Beer introduced cystoscopic diathermy, or "fulguration" as he termed it, as a method of treating benign villous growths of the bladder. We have, therefore, had ample time to observe the results obtained by his method, and to discover its limitations. I thought it might be of interest if I gave a brief summary of my experience in this treatment, especially as I believe that some of the conclusions I have reached are not universally accepted.

Evolution of Vesical Papillomata.—It is necessary to allude to the evolution of these growths, as it has an important bearing both on the treatment adopted, and on the prognosis of the patient's ultimate condition.

A villous growth usually arises on the postero-lateral wall of the bladder, a short distance above and to the outer side of the ureteric opening. In its earliest stage it appears as a single process of varying length, but branches soon arise from the main stem. When a patient is cystoscoped for hæmaturia, one finds, as a rule, a well-developed growth with many branches. If it is left untreated, it not only increases in size, but also tends either to become malignant or to give rise to secondary benign tumours. It is a curious fact that malignancy only arises in growths that have remained single, while multiple tumours do not invade and infiltrate the bladder-wall, no matter how numerous and luxuriant they may become. This generalization only holds good in cases in which no treatment has been carried out. If treatment has been ineffectual in curing the patient, it may stimulate these multiple growths to become malignant. I quote the following cases as examples of this rule.

(I) The patient was a man aged 45, who had suffered from hæmaturia for fifteen years, but who had never been cystoscoped, and had only received medical treatment. I found a very large villous carcinoma springing from the left lateral wall of the bladder, and secondary deposits in the glands round the internal and common iliac vessels on that side. The growth was single, and I removed it to relieve the patient of his symptoms. He lived in comparative comfort for six months, and died from generalized carcinomatosis.

(II) The patient was a man, aged 52, who had had intermittent hæmaturia for eighteen years, which, he said, never gave him any inconvenience except when he was passing clots, and for which he had never sought advice. I failed to see anything with an ordinary cystoscope, but with a cysto-urethroscope I found great masses of growth apparently covering the whole bladder. I cut down on the bladder, and could not find any evidence of malignant infiltration of the vesical wall. The interior of the bladder, with the exception of a small

area at the apex, was covered with great masses of non-infiltrating villous growth, which I burnt away by open diathermy.

Vesical papillomata may be divided into two groups, according to their histological appearances. In the first group, the epithelium covering the individual villi is similar to the normal vesical epithelium. It consists of three or four layers of fusiform or polygonal cells, arranged with their long axes at right angles to the stem. These cells are perfectly regular in size, shape, and staining reactions. In the second group, the epithelium is much more luxuriant, and is composed of as many as from twelve to fifteen layers of cells. These cells and their nuclei are irregular in size, shape, arrangement, and in their power of taking up stains. Mitotic figures are also common. There is thus a great hyperplasia of the epithelial elements, but as they do not grow down into the underlying tissues, these tumours are not malignant in the strict sense of the term. However, they form a connecting link between the first group and the true epitheliomata. Their clinical importance was first pointed out by Zuckerkandl in 1910. He showed that their removal was often followed by a true malignant recurrence, while recurrences after removal of growths belonging to the first group, were always benign. Tumours covered by this atypical luxuriant epithelium have been called malignant papillomata. This description is inaccurate, both from the pathological and from the clinical point of view, and I think it should be abandoned. It is far safer and more accurate to say that there is every variation between the typically benign growth, covered by normal epithelium, and the true malignant tumour which infiltrates the bladder wall, and that the more luxuriant the epithelium covering the villi, the nearer they approach malignancy. On the other hand, if one treats these non-infiltrating growths by diathermy one can afford to ignore the nature of the epithelium, as all are equally amenable to this method of treatment.

Results of Excision of Vesical Papillomata.—When estimating the value of the results obtained by a comparatively new form of treatment, one should compare them with the results of previous methods. I shall, therefore, briefly recapitulate the results I obtained by excision. I purchased my first diathermy apparatus in the winter of 1913-14. Before then I had operated on thirty-nine cases of vesical papilloma. In thirty the growth was single, while, in the remaining nine, two or more growths were found when the bladder was opened. Taking the thirty cases of single growth first, I had four recurrences after operation. Two of them occurred within a year. One patient was treated by excision, and he is perfectly well, twenty years after his first operation. The recurrent growth in the second case was treated by cystoscopic diathermy, and this patient has also remained well since. The late recurrences were remarkable. In one of these a small growth, about the size of a pea, was discovered at the site of the original tumour six years after operation. It was destroyed by cystoscopic diathermy. The last case was also interesting. At the original operation I thought the growth was malignant, and removed a considerable area of the whole thickness of the bladder wall. The histological examination, however, showed that it was benign. This patient was free from symptoms for eight years, then he had a slight attack of hæmaturia, coming on about once a year for the next five years. He returned to hospital thirteen years after operation complaining of difficulty of micturition. I found that he had 20 oz. of residual urine, the cause of obstruction being an enormous growth surrounding the internal meatus, and infiltrating the bladder wall. I re-opened the bladder, and burnt the tumour away by open diathermy, but it rapidly recurred and the patient died a few months later.

The results of operation in the nine cases of multiple growths were deplorable. In every case there was a rapid recurrence, and all the patients died from the effects of these growths within five years of the date of the operation. In two of these cases I had definite proof that the recurrent tumour was malignant, and I suspect that it was also malignant in one other.

From this small series one learns that : (1) No form of excision can offer complete immunity from recurrence. With careful technique, one can minimize the number of early recurrences, but one cannot influence the number of late recurrences. As a matter of fact, I have observed them after every kind of treatment. (2) That excision holds out practically no hope of a cure in cases of multiple growths. (3) That a considerable proportion of all recurrences are malignant.

Results of Cystoscopic Diathermy.—In tabulating the results obtained by cystoscopic diathermy, I have divided the cases into three groups : (1) Cases in which only one tumour was found. (2) Cases of multiple growths. (3) Recurrences after open operation.

(1) Single growths.—Although I have treated between sixty and seventy of these by cystoscopic diathermy, I have only been able to obtain reliable information in twenty-six cases, five years after the cessation of treatment. All cases treated within the last five years have been omitted, unless a definite recurrence has been found. They are considered to be still under observation. Five years is the usual time for which I keep these patients under observation, but it is really too short, as some of the "late recurrences" are only discovered at a much longer interval after treatment. I found recurrences in six of these twenty-six cases. Five were benign, and one was malignant. The benign recurrences were all situated at or near the site of the original tumour. Two were discovered within a year, two about three years, and one fourteen years, after treatment. In this last case the growth was only about the size of a pea, and forms an excellent example of a "late recurrence."

The last case of these six recurrences was of an entirely different type. This patient had a small pedunculated growth springing from the left lateral wall of the bladder. It was easily destroyed in three sittings. He was asked to return in six months for observation, but did not report himself till two and a half years later, when he had a return of the hæmaturia. I found a large, ulcerating carcinoma, apparently quite devoid of villi, springing from the site of the original growth. It formed an easily palpable tumour in the pelvis, and was obviously inoperable. The transformation from a villous growth into a non-villous carcinoma is uncommon, but I have seen another example of it. On the whole these cases did very well, twenty-five out of twenty-six being apparently cured, although five of them had to submit to two courses of treatment.

(2) Multiple growths.—I have treated twenty-eight patients, who had two or more growths when first seen. In most of these the tumours were so large and widespread that no attempt was made to count them. It was exceptional to find less than five or six. In every case small recurrences were found soon after the bladder had been cleared of growth. They usually appeared from six to twelve months after treatment. One must not conclude from this that these patients did badly ; most of them did exceedingly well, and were entirely free from symptoms after about the third or fourth sitting, and the recurrences were all noticed and destroyed before they caused hæmorrhage. They tended to diminish in number as time went on, and one could safely promise freedom from further trouble after they had been under observation for about three or four years. The following case serves as an illustration of the result obtained :—

A man, aged 45, was sent to me in 1914. His doctor stated that two years previously he had been diagnosed as suffering from an inoperable carcinoma of the bladder, but he thought there must have been some mistake, as his general condition was still good. I found that his bladder was almost completely filled with large masses of villous growth. I could not tell where they originated, or how many there were. I fulgurated them through the cystoscope, and got his bladder clear in six months. Towards the end of that year he had a small recurrence which I destroyed, and a second was burnt away in 1915. During the years 1916-1918 six small recurrences were fulgurated while I was on active service. In

1919 I destroyed two growths, and in 1920 one. His bladder then remained clear for over five years, and he was discharged as cured in 1926. In 1928 he returned saying that he had another attack of hæmaturia. I found two small recurrences, which were easily destroyed. Since then he has remained well and still comes up twice a year for observation.

I have had two absolute failures in this series.

The first case was that of a man who first consulted me in the spring of 1927. He had great masses of growth on both lateral walls and the anterior wall of the bladder, as well as a ring of growth round the internal meatus. I destroyed most of them in five sittings. He was then free from symptoms, and did not come back for treatment until he had another attack of hæmaturia, eighteen months later. I then found that both the tumours on the lateral walls had become malignant. I had him taken into hospital, destroyed the growths by open diathermy and inserted radium into the bladder wall round their bases. The patient did very badly, and six months later had a large secondary growth in the sacrum.

In the second case the patient absented himself from treatment for eight months, and returned with a large sloughing carcinoma.

I have never seen any signs of malignant degeneration in cases in which cystoscopic diathermy has been carried out completely and without interruption.

If one compares these results with the uniformly disappointing results obtained by open operation, one must be struck by the incontestable superiority of the cystoscopic method. The one objection to it is the time it takes, but with a modern apparatus I have been able to cut down the number of sittings to about a third of what was originally necessary. There are still cases in which it is essential to perform an operation, as, for example, cases of clot retention, or when the patient is bleeding so profusely that something radical must be done to stop the hæmorrhage. In these cases I open the bladder and destroy the growth by open diathermy. The suprapubic fistula is usually kept open till the bladder is clear of growth and sloughs.

(3) Recurrences after open operation.—These may be multiple or single. In the latter case they do not now give rise to any difficulty, but in the past many of them could not be reached with the cystoscopic electrode. Recurrences after operation are most frequently found at or near the suprapubic scar, and when they are in this position they are out of reach of an electrode passed through an ordinary catheterizing cystoscope. It was to deal with these cases that I introduced a special electrode carrier. In this connection I may quote the case of an American physician who consulted me in 1926. Three years previously a vesical papilloma had been diagnosed. The bladder was opened and a tube of radium was left in contact with the growth. The sinus was kept open for over a year. In 1924 the sinus was resected and the growth excised. The following year a small recurrent tumour was found on the anterior wall of the bladder, which the patient's New York surgeon could not reach through the cystoscope. The bladder was re-opened and the growth removed. The following year (1926) he noticed a return of the bleeding when he was in London. He was cystoscoped by a colleague, who found a small papilloma on the anterior wall of the bladder, and who, knowing that I was interested in these cases, asked me to see him. When he came to me he was in an extremely nervous condition, as he thought that he would require an open operation every year of his life. I cystoscoped him, and burnt away the growth in my consulting room. He was so pleased with the result that he immediately purchased one of my instruments, saying that he would never be without it. Fifteen months later he wrote saying that he had another small recurrence in the same place, and that his New York surgeon had had no difficulty in destroying it with my cystoscope. Single recurrences after operation can now be dealt with by cystoscopic diathermy, no matter

where they are situated. The growth, however, tends to come back again after treatment, but in all the cases I have seen the ultimate result has been good.

Multiple recurrences after open operation constitute the most difficult class of case with which one has to deal. The tumours show an inveterate tendency to recur, and often become malignant. I have not yet succeeded in curing one of them. The best I can achieve is to keep the patients free from symptoms and the growths under control by constant supervision. I will quote two cases illustrating the difficulties encountered:—

The first patient was aged 38 at the time of his first operation, which took place in the summer of 1918. Three growths were then removed. The following winter he was again operated on, and "several" growths were excised. He was cystoscoped in April, 1919, was told that he had "several splashes of growth in his bladder," and was advised to come to me for fulguration. He consulted me in October, 1920, when he had been passing blood every day for seven months. I found enormous masses of growth filling the greater part of the bladder; only a small area high up in the left lateral wall was clear. I commenced treatment, but it was very tedious as the patient was nervous and did not tolerate the cystoscope well. His bladder was clear in March, 1922. He was cystoscoped every three months from that date till January, 1926. One or two growths were found every year, and were destroyed as they appeared. His bladder was clear in January, 1926, and he was asked to return in the following May. He stayed away till September, and only returned then because he had hæmaturia. When I cystoscoped him, I found an enormous carcinomatous ulcer, about two inches in diameter, under the suprapubic scar; it was non-villous. I resected the anterior half of the bladder, and had to take away the anterior portion of the prostate and prostatic urethra in order to keep clear of the growth.

Since then this patient has been cystoscoped four times a year. There has been no recurrence of the carcinoma, but on almost every occasion I have found small villous growths, which were easily burnt away.

The second case is that of a man who had an attack of hæmaturia in 1919. A "papillary epithelial growth" was removed at a general hospital that year. The growth was considered to be malignant. Two years later a second operation was performed at another general hospital, but no information could be obtained as to the nature of the tumour removed. In December, 1923, the patient came to St. Peter's Hospital with an extensive villous growth surrounding the internal meatus, and another on the anterior wall. They appeared to be benign, but as the original growth was thought to be malignant, I admitted him, and nipped off several fragments for microscopic examination. They were reported as benign, so cystoscopic diathermy was commenced. In September, 1924, the ring round the internal meatus was entirely destroyed, but the growth on the anterior wall was increasing rapidly in size, and was thought to be malignant. I admitted him to hospital and excised approximately the anterior third of the bladder. No evidence of malignancy was found on histological examination. Within six months there was a small recurrence on the anterior wall. Since then he has attended hospital from four to six times a year, and on every occasion fresh nodules have been discovered and dealt with. All of them have occurred on the anterior wall, the rest of the bladder has been absolutely clear.

Both these patients, and several others with the same type of history, have been free from symptoms, and have been able to lead normal lives, but I have little hope of curing any of them. They are, however, in a very much better condition than patients suffering from recurrent growths before fulguration was introduced. We then found them, bled white, coming up year by year for their annual operation, and receiving less and less benefit from each successive interference. I believe that the only operation that would completely relieve these cases of multiple recurrences, and, indeed, all cases of multiple growths, is a total cystectomy. I proposed it to several patients in the days before fulguration, but they always refused it. One wonders what will be the future for these patients. Will it be necessary for them to have continuous treatment for the rest of their lives, or will all the growths ultimately become malignant? Even if a malignant tumour is excised, it does not guarantee them against the necessity of further treatment.

When one compares the results obtained by cystoscopic diathermy with those following excision, I think one must admit that the former method is the more satisfactory. When only one growth is found, good results may be obtained by either method, and, indeed, the proportion of recurrences following fulguration is greater than that following operation. On the other hand, recurrences after fulguration are more easily dealt with than those after operation. The former are usually found at or near the site of the original tumour and do not present any increased difficulty in treatment, while those after operation frequently occur near the suprapubic scar, where they are difficult to reach. Apart from this, there is no doubt that cystoscopic diathermy is much less of an ordeal for the patient than any operation.

When dealing with multiple growths, or multiple recurrences, I found the results of open operation uniformly bad. All the patients grew steadily worse while under treatment, and all died from the effects of their growths. With cystoscopic fulguration, although it is difficult to speak of a cure, one is able to keep the patient in good health, and to preserve his capacity for work. I feel that it is in this type of case that the superiority of the cystoscopic method is most evident. There is, however, one objection to it. It necessitates great skill and much time on the part of the surgeon, and considerable patience and fortitude on the patient's side. I have two patients, each of whom I have cystoscoped more than a hundred times, and several others who have had about fifty treatments.

The more I see of these non-infiltrating villous growths, the less I am inclined to open the bladder, and the larger and more widespread the growths, the more anxious I am to treat them through the cystoscope. If an open operation does not cure the patient it leaves him worse off than he was before it. It has proved uniformly unsuccessful for multiple tumours, and I believe that in these cases it should be avoided unless urgently indicated.

Indications for Cystoscopic Diathermy.—I have already given most of the indications for this line of treatment. It should be instituted in all cases when the patient can be cystoscoped, and when the growth does not infiltrate the bladder wall. Patients with uncontrollable hæmorrhage, or with clot retention, cannot, of course, be cystoscoped, and require a cystotomy. If a patient suffering from a urethral stricture has symptoms suggestive of a vesical growth, an internal urethrotomy should be performed as soon as possible, and he should be cystoscoped while he is on the table. Apart from these cases, it is exceedingly seldom that cystoscopy cannot be performed. If the bladder is so full of growth that practically no cavity is left, one can generally obtain a limited view through an irrigating cystourethroscope. A few sittings of diathermy through this instrument will usually increase the capacity of the bladder sufficiently to allow a complete cystoscopy. I have followed this plan in a few cases, and have been able to clear the bladder without opening it.

The decision as to whether the growth is suitable for cystoscopic treatment may be difficult. A single growth is either pedunculated or sessile. If it is pedunculated, all that one need do is to test its mobility. This is readily accomplished by thrusting a diathermy electrode into it, and turning the current on for a few seconds. The growth adheres to the electrode, and if it follows the latter when it is withdrawn, or moves from side to side, one need have no hesitation in deciding that the case is suitable for cystoscopic treatment. If, on the other hand, the growth appears to be fixed, and breaks away from the electrode when any traction is put upon it, one should consider it to be malignant, and perform a partial cystectomy. The appearance of the growth is also of help. If the villi are long and thin, and wave about in the eddies of the water, the whole growth is always movable, and suitable for cystoscopic diathermy. If the growth is firm, compact, and covered with short villi, it should only be fulgurated when it is freely movable.

Single sessile growths should always be treated as malignant, unless they are recurrences after an open operation. I have not yet seen a benign sessile growth in a patient who has not received treatment, and even when they were quite small they always proved to be malignant on microscopic examination. Recurrences after operation are often sessile, although the original tumour was pedunculated. Some of these are apparently innocent, and can be treated through the cystoscope. Most of the growths appearing near the suprapubic scar are of this type, and if the surgeon has any suspicion that they are malignant, it is far safer for him to excise the anterior portion of the bladder. I have seen nine cases of true malignant recurrences after operation, and eight of them were on the anterior wall. On the whole, if these sessile growths are small and easily reached, they may be fulgurated through the cystoscope, but if they are large, it is safer to operate.

In the case of multiple growths, one should consider recurrences apart from untreated cases. If the patient has received no treatment, it is almost certain that the growths, no matter how large and luxuriant they may appear, do not infiltrate the bladder wall, and are therefore suitable for cystoscopic treatment. Multiple carcinomata of the bladder are not common, and when they are noticed the smaller are usually contact-growths from the larger. In these cases the original growth is unmistakable, and there is no difficulty in making a diagnosis. If the patient has already been operated on, one should look for signs of malignancy in the growths on the anterior wall. The diagnosis is often difficult, but a very large sessile growth in this region should be considered as probably malignant, and should be removed. I have removed at least two innocent growths of this type, under the impression that they were malignant. When these recurrent growths are all much the same size, they are almost certainly benign.

Choice of Instrument.—Much of the success in treating bladder growths by fulguration depends on the choice of cystoscope. No one type of instrument is suitable for treating growths in all parts of the bladder, and the surgeon can save himself much time and trouble by selecting the most suitable instrument for the particular case he is treating. Fortunately, most primary growths are situated a short distance above and to the outer side of the ureteric orifices, where they are easily reached by the ordinary catheterizing cystoscope. It is only when a tumour is found in some unusual part of the bladder that a special instrument is necessary.

The only points one need emphasize in considering different instruments are the type of telescope, and the electrode carrier. The instrument makers have now given us a number of different types of telescopes, depending on the nature of the prism used. They are the straight telescope without any prism, the telescope giving oblique forward vision (called by the German manufacturers the "prograde" telescope), the ordinary right-angle telescope (first introduced by Nitze), the telescope with oblique backward vision (usually called the "semi-retrograde" telescope), and the complete retrograde telescope. The straight and the prograde telescopes are habitually used in posterior urethroscopies, but I do not think they are of much value in the bladder. Their one advantage is that it is easy to keep an electrode in view, no matter how far it may be extruded. The ordinary right-angle telescope is by far the most useful instrument for ordinary cystoscopy, and with it one can see the whole of the bladder wall, except for a small area just in front of the internal meatus, which is invisible in the male, but can always be seen in the female. The reason for this is that the instrument lies obliquely in the bladder. One is apt to imagine that it follows the direction of the posterior urethra. If it did, the whole of the bladder wall would be visible, but in this case the handle of the instrument would project through the patient's perineum. A cystoscope introduced through the male urethra is held in front by the suspensory ligament of the penis, and behind by the prostatic urethra. Its shaft points obliquely upwards and backwards. This brings the beak and the prism of the telescope close to the posterior wall of the

bladder, and facilitates catheterization of the ureters, and fulguration of tumours lying on the base. If the instrument is turned round for inspection of the anterior wall, only a distant view is obtained, and although the prism can be brought nearer this part of the bladder by depressing the handle of the instrument, it can never be brought as close to the apex as to the base. Again, if the cystoscope is slowly withdrawn while its point is directed upwards, the internal sphincter will obscure the prism before the lower part of the anterior wall comes into view. A semi-retrograde telescope, however, enables one to inspect this portion of the bladder.

A complete retrograde telescope is rarely necessary in the treatment of bladder tumours, as those near the internal meatus can be seen with the semi-retrograde telescope, and those actually at the internal meatus can be burnt away through a posterior urethroscope.

The second point is the electrode carrier. The Albarran lever, used in the ordinary catheterizing cystoscope, is the simplest and most practical means of directing an electrode on a growth. It has, however, one great disadvantage, in that it only raises the electrode to the angle of about 45 degrees from the shaft of the instrument. If the growth is at any distance from the prism of the cystoscope, the electrode passes completely across the field of vision, without coming anywhere near it. For this reason it is unsuitable for dealing with tumours situated on the anterior wall of the bladder, although it is very efficacious in dealing with growths on the posterior and lateral walls. The cystoscope can be brought near these tumours, and the electrode can be placed accurately on their surface. It can also be used in conjunction with a prograde telescope, as the electrode can be directed along a line parallel to the principal ray. Unfortunately with this form of telescope, tumours on the anterior wall are invisible. After several experiments, I devised a special form of electrode carrier for dealing with distant tumours. It can be used with either the right angle, or the semi-retrograde telescope, and it has enabled me to deal with recurrences on the anterior wall of the bladder which were quite out of reach of the ordinary instruments. By means of these improvements—the semi-retrograde telescope, and the special electrode carrier—one is able to extend cystoscopic fulguration to tumours situated in any part of the bladder.

Three instruments are required for this work. They are: (1) A posterior urethroscope, which is necessary for treating growths in the urethra and at the internal meatus, and for very large tumours almost filling the whole bladder. (2) An ordinary catheterizing cystoscope for dealing with tumours on the base or the lateral walls of the bladder. (3) A semi-retrograde cystoscope, with a special electrode carrier for treating growths on the anterior wall, or close to the internal meatus. As a matter of fact I always use an ordinary catheterizing cystoscope whenever possible, and with it I can treat most of the tumours met with. The semi-retrograde instrument is chiefly required for recurrences after open operation.

Technique of Cystoscopic Diathermy.—It is hardly necessary for me to discuss the technique in detail, as most of us use approximately the same method.

There are two ways of destroying these growths. The first is to burn the tumour superficially, wait till the sloughs separate, and then attack the portion that is left. In this way the tumour becomes smaller and smaller after each sitting, and the pedicle is the last portion to be destroyed. This method takes time, but it is rarely associated with secondary hæmorrhage or other complications. The second method is to attack the pedicle first. This is easy if the stalk is visible, but one rarely sees it. The electrode is plunged deeply into the growth and the current turned full on. I always like to see a brisk evolution of bubbles from different parts of the tumour. As soon as the growth becomes adherent to the electrode, I pull on the latter so as to raise the tumour as far as possible off the bladder wall. As the water in the bladder offers more resistance to the current than the tissues, most of the electricity passes from the growth to the bladder wall through the stalk, and may

coagulate its tissues. With this method the number of sittings can be materially reduced, but as the sloughs take longer to separate, one has to allow a longer interval between each treatment.

The size of the electrode should correspond with the strength of the current. If a large electrode is used with a weak current, the amount of coagulation may be practically nil. Using a small portable apparatus, I find that I can obtain more rapid destruction of tissue with a No. 6 than with a No. 10 electrode. On the other hand, a large electrode should be used with a powerful current, as otherwise the wire may become so hot that the insulation is damaged. I also use electrodes with the smallest metal tips that I can procure. They give an intense burning effect at the point of contact, and I think that one obtains a better penetrative effect with them. The path of the current through the tissues, from the point of the vesical electrode to the large flat plate on the patient's abdominal wall, may be considered to be, roughly, cone-shaped. One may also assume that the amount of heat generated in each cross-section of the cone is approximately the same. It follows that the temperature at its apex is raised to a much higher degree than at its base. The effect of using a large electrode without at the same time increasing the current, is simply to cut off the apex of the cone. One obtains a larger area of action, but the intensity of the action is correspondingly reduced, and the temperature may not be raised sufficiently to coagulate the tissues. As a general rule the strength of the current should be in direct proportion to the area of the electrode in order to obtain a uniform burning effect.

Occasionally one finds that the insulation of the electrode is defective. This was formerly quite a common failing, but it is now becoming rare. Defective insulation is not easy to detect; all that one notices is that the growth seems to resist the effect of the current. As a matter of fact, the current does not pass through the growth, but it leaks into the cystoscope and from that into the tissues. This leakage is not felt by the patient, and may be quite unsuspected. My attention was first called to this in a rather curious way. A patient came to me with a large number of tumours in his bladder. He also had a wide calibre stricture, which gripped the cystoscope rather tightly. The first time I fulgurated in this case I could not understand why I could not obtain a satisfactory burning effect. The next time I saw the patient he said that he had had a good deal of pain in the urethra during the interval. I passed a urethroscope and found a ring-shaped ulcer instead of the stricture. I then tested the electrode and found it was leaking badly. At the first sitting the current had evidently leaked into the cystoscope and had burnt the stricture away. The simplest method of testing the insulation of an electrode is to couple up one pole of the diathermy apparatus to a flat metal plate, and the other to the electrode to be tested. If the electrode is held parallel to, and about an inch or so over the plate, a brush discharge will be seen coming from its whole length. This happens even when the insulation is as perfect as possible, and can best be observed when the room is darkened. If, however, the discharge is chiefly concentrated on one spot, it indicates that the insulation is defective there.

Some authors have described a type of growth which they consider to be resistant to diathermy, though they do not appear to have differed histologically from ordinary tumours. I believe that in these cases an electrode with defective insulation was used. It is difficult to see how any living tissue, no matter what its nature may be, can resist the action of heat. Coagulation must take place if the heat is properly applied.

The question of anæsthesia is debatable. Some surgeons give a general anæsthetic for every sitting. This has the advantage that one can use a large electrode, a powerful current, and can destroy the growth in a comparatively small number of applications. It has the disadvantage that if one is not expert, one may do harm. As long as the electrode is properly applied to the tumour, no pain is felt, but if it

touches the bladder wall, severe pain is experienced. Pain is a danger signal which is abolished by anaesthesia. Some time ago a clinical assistant was treating a case at St. Peter's Hospital. The passage of the current appeared to be exceedingly painful, so I asked him to let me have a look down the cystoscope. I found that he had passed the electrode completely through the growth, and was cauterizing the bladder wall behind it. I only give a general anaesthetic if the patient particularly asks for it, or if there is great difficulty in passing a cystoscope without it. Most of my patients have been treated either in the out-patient department, or in my consulting room, without any general anaesthetic. If the growth is large, a great amount can be destroyed at a sitting, if it is small, pain is a valuable indication that the current has spread beyond the limit of the growth. The last sitting is usually the most painful, but I find that patients are content to endure it if they realize that no further treatment will be necessary.

Conclusions.

(1) Open excision of vesical papillomata only gives good results when the growth is single. When two or more growths are found, the results are uniformly bad; the growths rapidly recur and there is a great tendency for them to become malignant.

(2) The proportion of recurrences after cystoscopic diathermy in cases of single growths is slightly greater than that after excision, but the recurrent tumours are easily destroyed, and the late results are exceedingly good.

(3) Good results are ultimately obtained, in cases of multiple growths, by cystoscopic diathermy, although early recurrences are always found. If the recurrent tumours are destroyed as they arise, the tendency towards tumour formation gradually disappears.

(4) Recurrences after open operation are the most difficult type of case encountered. If single, they can be cured by cystoscopic diathermy; if multiple, they are apparently incurable, but if the patient attends regularly for observation, he can be kept in good health and free from symptoms.

Discussion.—The PRESIDENT said most Members would agree that the operation of choice in dealing with these growths would be intracystoscopic diathermy, and if the patient were given the option he would choose to have that method. It was, however, doubtful whether the patient should be given the choice. In a suitable case that treatment gave better results, both immediate and remote, than did other methods. If a case was not suitable for that treatment, any method would give bad results. All late cases were difficult cases.

Multiple papillomata did not become malignant, but he had been impressed by the late recurrence of innocent papillomata in the suprapubic scar. In one case operation had been performed by a surgeon many years before he (the speaker) saw the patient, and there was a recurrence of three papillomata in the bladder. These he (Mr. Jeans) had treated intracystoscopically. He had also seen two or three other intravesical recurrences, which had occurred only after an interval of many years in the middle of the suprapubic scar.

He had bought one of the instruments Mr. Swift Joly had described. The user would do well to pass the ureteral catheter a fair distance before beginning to bend it, so as not to spoil the wire arrangement. This instrument made accessible a part of the bladder which could not previously be reached.

He agreed that the absence of a general anaesthetic was a distinct protection to the patient in every form of intravesical manipulation.

Mr. H. P. WINSBURY WHITE said that Mr. Joly had called attention to the ease with which simple growth could be identified through the cystoscope, and had indicated the outstanding characteristics of malignant tumours observed in that way. There was, however, an intermediate group of bladder growths which it was not so easy to classify on a first cystoscopic examination, that was to say, it was doubtful whether they were innocent or malignant. In such cases his (the speaker's) custom was to use electro-coagulation, more or less as a test. He applied the electrode with a view to observing the nature of the reaction and comparing it

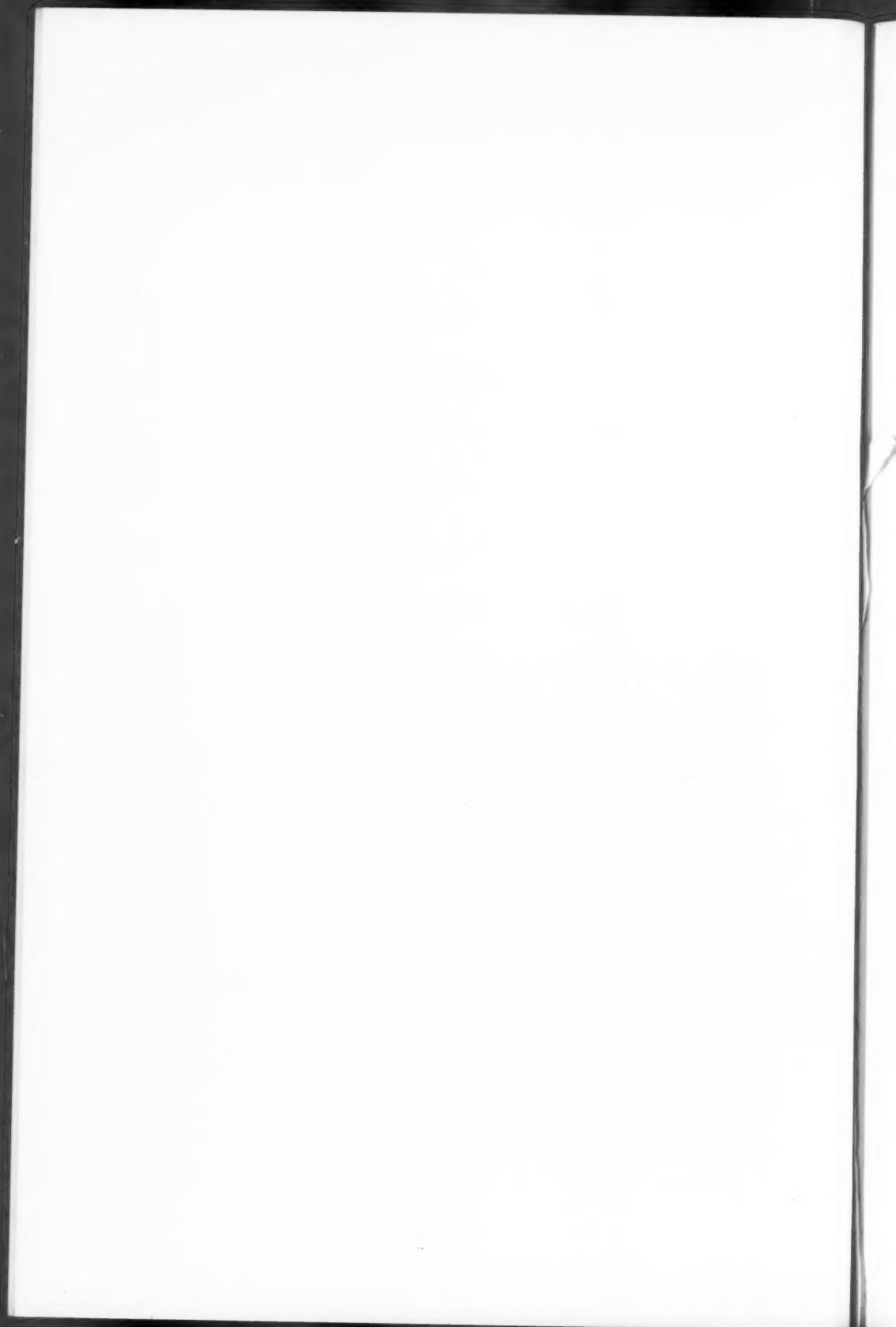
with that which he knew should occur in the case of a simple growth, when he examined the bladder a second time. In order to make up one's mind quickly by this method, one should endeavour to destroy a very large part of the growth at the first sitting. It was of no use, therefore, to employ a small electrode with a weak current; such a procedure would occupy a considerable time, without destroying as much of the growth as was essential for the test. This consideration had impelled him (Mr. Winsbury White) to devise a cystoscope which enabled him to destroy a large amount of growth at one sitting. The essential feature of such an instrument was that it should have a very considerable inflow of water—a more adequate one than was obtained by irrigating cystoscopes as a rule. The inlet channel of these irrigating cystoscopes did not go completely into the bladder, but simply opened into the lumen of the sheath, and therefore one could not get an irrigation sufficiently continuous to keep a clear field of vision as long as was required. In the instrument which he had devised, the inlet channel went right into the bladder. This, no doubt, suggested that much space in the sheath would be taken up by this addition, but this difficulty had been cleverly obviated by making the inlet channel a narrow space between two sheaths, still leaving room for a large field telescope and a large electrode.¹

He had used the instrument for dealing with a number of growths, and had been delighted with the speed at which it enabled him to work.

Mr. SWIFT JOLY (in reply) said that there were doubtful points, both as to the nature of the growths and as to the method of treatment, but he was more and more inclined, when he could not make up his mind as to the nature of a particular growth, to regard it as malignant. There had been some cases, especially post-operative ones, in which he had removed an innocent growth under the impression that it was malignant. As these recurrences after open operation occurred in the anterior scar, it was an easy operation and could be performed rapidly and with very little shock to the patient.

He had seen Mr. Winsbury White's instrument and considered it a very good one. He (the speaker) used an electrode carrier, and he had two taps for water, so that the stream went along the surface of the electrode and was directed straight at the spot on which the operator was working. He did not often use it, because as soon as the medium became turbid, he removed the telescope and washed out the bladder before replacing it. He sometimes washed out the bladder three or four times at a sitting. He carried out as much destruction as possible at each sitting; it was hopeless to tinker with these growths. In the case of large tumours he was not satisfied unless the current was on for fifteen or twenty minutes. All the anaesthesia required was a local anaesthetic for the urethra.

¹ The calibre of the instrument is 24-Charrières. The telescope gives a 30 mm. field at a distance of 1 in. The operating channel carries an electrode of 24 Charrières.



Section for the Study of Disease in Children.

ANNUAL PROVINCIAL MEETING, JUNE 21, 1930, AT THE JENNY LIND
HOSPITAL, NORWICH.

Young Man with Arrested Development; Neanderthal Type of Physiognomy.—A. J. CLEVELAND, M.D.

E. B., aged 22 years. Healthy at birth, growth retarded in infancy. Appearance never that of a typical cretin.

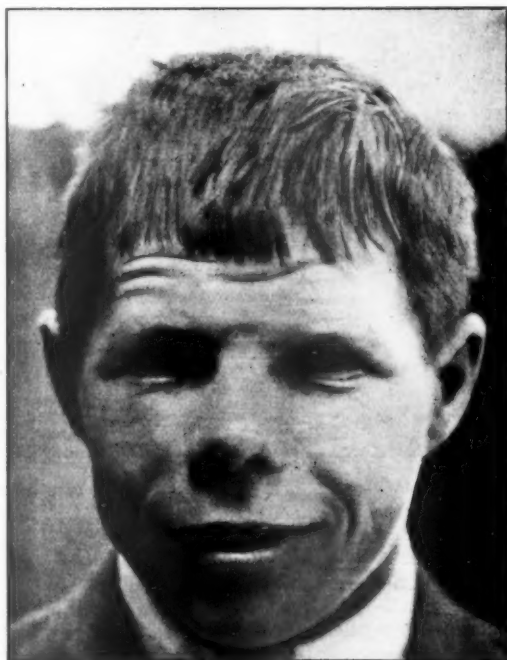


FIG. 1.—Neanderthal Type of Physiognomy: Dr. A. J. Cleveland's Case of Arrested Development.

Administration of thyroid failed to improve growth when first seen (at about age of 6 years), but during the last few years has caused considerable improvement. Skiagram of skull shows normal sella turcica.

SEPT.—CHILD. 1

Members would have been interested to see this young man fifteen years ago. I speak of a "Neanderthal type of physiognomy," because at that age (7 years) he resembled our primitive cousins more closely than he does now. It raises the interesting point on which Sir Arthur Keith touches in his "Antiquity of Man," namely, that certain types of primitive man and of pathological man closely resemble each other. When he was 4 or 5 years old this boy had beetling brows, a bowed back, a shuffling gait, and a curved lower jaw. Those resemblances are, however, more superficial than real. A skiagram shows that the superciliary ridges are due to well-developed frontal sinuses, and there is a definite mental process. Under thyroid treatment he grew $9\frac{3}{4}$ in. between April, 1927, and October, 1929, his best record for growth.



FIG. 2.—Neanderthal Type of Physiognomy. (Dr. A. J. Cleveland's case.)

Double Colon.—Sir HAMILTON BALLANCE, K.B.E., M.S., F.R.C.S.

Girl, aged 10 years, admitted to the Norfolk and Norwich Hospital, April, 1926.

At the lower end of the posterior vaginal wall there were two rectal orifices, right and left. There was an anal dimple on the perineum, $1\frac{1}{2}$ in. behind the vaginal orifice.

An attempt to cure the imperforate anus four years previously at Great Ormond Street Hospital had failed. A further attempt was made when the child was admitted to the Norfolk and Norwich Hospital, but that also failed.

To obtain a clear field for the perineal operation a temporary colostomy in the transverse colon was performed. Four months later the colostomy was closed, and at this operation it was found that the doubling of the colon extended nearly or quite

as far as the cæcum. Some inches of the transverse colon were excised, and a specimen of it is shown, also a microscopical section and skiagrams.

In the septum there is some fibrous tissue, but I do not think there is muscle. I gave part of that specimen to Sir Arthur Keith, who was much interested, and showed me three specimens of double intestine in the Royal College of Surgeons' Museum. One was from an infant, and in that specimen the last 6 in. of small intestine was double; the double small intestine opened into a double cæcum, and there were two appendices, but the ascending colon was single. The second specimen was from an ox in which the large intestine was double for about 18 inches. There was also a specimen from a young woman, and in that the colon was double for a



Barium in each rectum: catheter in the left. (Sir Hamilton Ballance's case of double colon.)

short distance. Sir Arthur Keith said he could only suppose this to represent a feeble attempt on the part of Nature to produce dichotomy. Something had happened to the embryo. He (the speaker) had been told that if a chick's embryo was tampered with, it could be made to grow a two-headed chicken, and that tampering with the embryo of a lizard caused it to grow two tails.

Discussion.—Mr. PHILIP TURNER asked whether there was any connection between the two intestinal tubes. The septum struck him as being fairly thin, and he agreed that no muscle was to be seen in the section.

Sir HAMILTON BALLANCE (in reply) said there were no openings in the septum of the double colon; it was a perfect septum through the whole length of the colon. The small

intestine appeared, on feeling with the finger, to be single. Fæces came down each rectum. He had not carried out an end-to-end anastomosis. He had closed both ends of the transverse colon and then performed a lateral anastomosis, overcoming the complication of a double colon by cutting away the septum at the site of the anastomosis.

Syringomyelia with Retrobulbar Neuritis.—H. J. STARLING, M.D.

Female, aged 15 years; one of nine children, of whom one died aged 9 weeks; others healthy. Father strong and healthy; mother has enlarged thyroid and is deaf.

The patient was always healthy until April, 1929, when she saw a doctor on account of lassitude. In July her right leg began to drag on the ground, causing difficulty in walking, and she was in bed for three weeks. She then got up and was able to walk normally for a month. Her left leg then began to drag, and shortly afterwards her right leg became weak again, and she has only walked—with difficulty—on two or three occasions since. She only complains of weakness in the legs and says they feel numb. Since her illness began she has had nocturnal, and sometimes diurnal, incontinence of urine, but no faecal incontinence. The appetite has been good and the bowels act regularly. On admission (March 19, 1930) she was fairly well nourished and her colour is good. The teeth are sound and the tonsils are not enlarged. The heart and lungs are normal. There is a curvature of the back, with convexity to the left in the dorsal region, and the ribs on the left side form a prominent bulge.

Nervous System.—Both knee-jerks present, but feeble. Right ankle-jerk feeble, left absent. Both triceps present, but both biceps-jerks absent. Plantar reflexes flexor. Marked loss of power in both hands. Left-hand muscles wasted, *main en griffe* present on the left side.

The pupils react to light and accommodation. Dr. Maxted reports that the right disc is normal, but the left disc shows definite partial atrophy, which he thinks is due to a retrobulbar neuritis; there is also a central scotoma in the field of vision on the left side. The abdominal skin reflexes vary, they were absent on admission, could be obtained on April 4, but were only present in the lower quadrant on May 5. There is distinct sensory loss on the left side, chiefly confined to the leg. Light touch is only just felt, definition between sharp and blunt is doubtful on the inner side, absent on the outer side, sensation of cold is weak and of heat is absent on both sides of left leg. There are patches on the outer side of the left leg where pin pricks are not felt.

Lumbar puncture was performed; the fluid was clear, but was not under pressure. Examination showed normal globulin and sugar. The cells were not counted and chlorides were not estimated. The Wassermann reaction was negative, both in the blood and in the cerebrospinal fluid. The catheter urine gave a growth of coliform bacilli on March 25, 1930, and again April 4. The urine also contained a few pus cells in the first examination only.

Electrical Reactions.—All the muscles of the right arm reacted to faradism and galvanism. Left arm: Deltoid, triceps and biceps react well to F. and G.; forearm: flexor sublim. digiti, no faradic response, G. R. sluggish. All other muscles react to F. Hand: All palmar interossei and fourth dorsal interossei, no response to F., slow to G.; third dorsal interossei, no response F., sluggish G. thenar eminence, all muscles react to F. and G. Hypothenar eminence, adduct. minim. digiti, G. and F. sluggish response. Flexor minim. digiti, no F. response, fairly good G. All leg muscles respond to F. and G.

After a little treatment with faradism the patient complained of tingling in the hands, which became so acute that the treatment had to be given up. The left hand was also put on a splint, but subsequently blisters developed on the palm and between the fingers, resulting from slight pressure. Her condition improved considerably, so that she could walk without assistance, and was no longer

incontinent. After treatment in the Norfolk and Norwich Hospital and in Guy's Hospital she was able to walk normally, and was discharged at the end of May. Since then the paralysis of both legs is reported to have returned.

Discussion.—Dr. WILKIE SCOTT suggested that the condition was subacute encephalomyelitis. Sometimes such a patchy distribution was a forerunner of disseminated sclerosis. He had seen a case much like this in a girl who had widespread weakness of arms and legs, as well as retrobulbar neuritis. Paralysis of all the limbs was so complete that recovery seemed impossible. Then she made a miraculous recovery, and went out of hospital with very little weakness, but she retained dorsiflexion reflex and nystagmus. Two years later she returned with the classical symptoms of disseminated sclerosis. The association of retrobulbar neuritis was against the diagnosis of syringomyelia, as also was the distribution of sensory and motor phenomena.

Dr. STARLING (in reply) said that when the retrobulbar neuritis was discovered he had thought of disseminated sclerosis, but the child had no symptoms which suggested that disease. There was perfect co-ordination of such limbs as she could use, and there was marked reaction of degeneration in the muscles of the left hand and arm. Also there were gross changes in the sensory symptoms, especially with regard to heat, cold and pain. He still thought syringomyelia was the correct diagnosis.

Cerebral Hæmorrhage in a Boy now aged 14 years.—F. K. HAYMAN, F.R.C.S.

April 27, 1926 (then 10 years old).—Dismounted from the back step of a bicycle and found his left leg useless. On examination was found to be perfectly conscious and remembered all details. He gave no history of trauma and had no signs of injury. The pulse-rate was 84. He was found to be suffering from: (1) Complete flaccid paralysis of left arm and hand; partial spastic paralysis of left leg with increased knee-jerk and extensor plantar response; partial paralysis of left side of face; hemianæsthesia affecting the left side, back and front, from head to foot. 28.4.26.—Left oculomotor paralysis appeared. All the symptoms improved rapidly and by May 19 (three weeks and a half later) he could walk fairly well and use his hand. Diagnosis.—Small hæmorrhage affecting the right crus cerebri. He has been doing clerical work, and his health remained good until this year.

February 17, 1930.—While at work was seized with severe vertical headache with vomiting and had to be taken home. Physical signs were absent and pulse and temperature were normal.

18.2.30.—Headache was worse. Head retraction, Kernig's sign +, and vomiting. Temperature 99.6°F.; pulse 80.

Lumbar puncture yielded an ounce and a half of fluid under pressure; it was freely mixed with blood. Marked relief was obtained for a few hours but the same symptoms recurred. Lumbar puncture was performed four times during the next ten days for the same symptoms, each time with temporary relief. His pulse and temperature remained normal after the first day.

Cerebrospinal fluid was examined three times and found sterile, and was throughout freely mixed with blood.

Diagnosis.—Leaking congenital aneurysm at base of brain.

Patient recovered, and by March 27 (five weeks from onset) was able to walk.

Wassermann reaction negative. Blood-pressure 118/60. Urine normal.

Discussion.—Dr. A. MONCRIEFF said that this case was interesting, because of the early age of the patient. The boy was fortunate to have survived two attacks of cerebral hæmorrhage. The first attack localized the trouble more on the right side of the brain, and he asked whether ligation of the right carotid had been considered. That might obviate further hæmorrhage and possibly a fatal termination. It was dangerous for the boy to go about with such a condition.

Dr. ERIC PRITCHARD asked whether accurate observations were made as to whether the blood present in the cerebrospinal fluid was derived from the lumbar puncture, or from a leaking aneurysm. In the latter case the fluid after subsidence of the red blood-corpuscles should be uniformly straw-coloured. Cerebrospinal fluid recently contaminated with blood showed no such colour change.

Dr. WILKIE SCOTT said that he agreed with the diagnosis. He had had a patient, a boy who had three attacks of hæmorrhage, the third being a fatal one. In each of these blood had been mixed with the cerebrospinal fluid, and the attacks had all come on after exertion. In the case of another boy the attacks had come on as in the case now described. There had been two, and the boy had remained well for a year after the second. Both had occurred while the boy was riding a bicycle.

Mr. HAYMAN (in reply) said that the blood was uniformly mixed with the fluid on every occasion, and its colour was bright red. He was obliged for the suggestion to ligature the carotid, but he did not consider that this procedure was practicable in the present case.

Arrested Development due to Disease of Pituitary Gland.—A. J. CLEVELAND, M.D.

Dennis W., aged 11 years.

Of ordinary size and development until age of 5 years, when he had a bad illness called "influenza," lasting three weeks, and accompanied by much sleepiness. Eyesight began to fail soon afterwards. Has not grown since and complains of much headache. Mentality good. No moral changes.



Disease of Pituitary Gland causing Arrest of Development. (Dr. A. J. Cleveland's case.)

One brother normal. Three of the family died at birth, two premature.

Visual fields much limited. Double optic atrophy.

Skiagram of skull shows enlargement of sella turcica with indefiniteness of outline.

He is now very much as he was at 5 years of age. Mr. J. L. Thomas has suggested to me that the condition may be due to a Rathke's cyst. I thought it

might be suitable for surgery, but I tried in vain locally and also in London to find anyone willing to undertake an operation. I think the boy's eyesight is progressively failing, and he has frequent headaches. Should we make another attempt to have him operated on?

Dr. B. SCHLESINGER said that he had had a somewhat similar case in a girl, and in that case gross adiposity had been an additional feature. Surgical treatment had been considered and fortunately the decision had been against it. Three years later, when the patient had again been examined, there was marked optic atrophy, but, despite her defective vision, he (Dr. Schlesinger) felt sure that she was better off than if she had had an operation. He thought that in the present case there was probably a suprapituitary tumour of congenital origin.

Unilateral Exophthalmos.—G. MAXTED, F.R.C.S.

Girl, aged 10 years.

Proptosis of the right eye was noted on her first admission to hospital in July, 1927, on account of acute rheumatic carditis.

She was again in hospital in December, 1927, suffering from pericarditis, with effusion and generalized cedema, and the proptosis was then slightly more marked.



Unilateral Exophthalmos. (Mr. G. Maxted's case).

The degree of proptosis has not altered since 1927.

The right eye is pushed straight forward, there is no diplopia or other symptom. The pupil reacts normally and the disc looks healthy.

Vision in the right eye $\frac{6}{12}$, but the eye has 3D. hypermetropia, the other being emmetropic. Movements of the globe unrestricted.

X-ray examination reveals no abnormal appearances in the orbital region, or in the neighbouring nasal sinuses.

The nose has been examined by Mr. N. S. Carruthers, who finds no abnormality. Readmitted to hospital in September, 1929, on account of cardiac failure.

The heart is enlarged; there is a loud systolic bruit at the apex and there are systolic and diastolic bruits in aortic area.

Sometimes I have thought the condition retrogressing. To what is the proptosis due? I do not know whether it is possible to connect it with the heart trouble. I thought there might be some non-malignant tumour of the optic nerve or its sheath, but such things are rare; I have not seen one.

Discussion.—Dr. F. J. POYNTON said it was difficult to associate the heart lesion with the other condition. The child had a bruise on her side, with purpura, and there were some purpuric spots. Also, there was a history of whooping-cough, and the eye had projected at that time. He thought that she was a rheumatic child with a tendency to bleeding, and that the whooping-cough had caused a hæmorrhage, which had been gradually absorbed, but had left the eye more prominent as a result.

Dr. B. MORGAN said that the child had come under his care owing to her cardiac condition, but he was unable to connect that condition with the optic trouble. There had been no hæmorrhages while she was in hospital. He had not seen her for six months, and no purpuric areas had been noted.

Dr. SCHLESINGER said he also thought that the proptosis was due to a retro-orbital hæmorrhage and suggested that it might be of interest to investigate the bleeding time, number of blood-platelets, etc., with this in view. With regard to the cardiac condition he thought that as there had been a history of pericarditis, the valvular lesion was presumably rheumatic in origin. The loud murmur and thrill over the pulmonary area suggested a congenital malformation, and it was quite possible that both congenital and rheumatic lesions were present.

Congenital Absence of Femur.—C. NOON, F.R.C.S.

Boy, aged 9 years.

First sent to the Norfolk and Norwich Hospital when he was aged 4 years. The right femur is absent, so that the right foot is on a level with the left knee joint. The right leg and foot are well developed. When first seen he could not walk. He has been fitted with an appliance which he has now used for about four years. This consists of a spinal carriage fitted with axillary supports attached to a pelvis band with a ring which fits on the ischial tuberosity attached to steels extending to the ground. A platform supports the right foot. The boy is able, by means of this support, to get about quite well. He can go to school and walks about a mile at a time.

It is of the greatest importance to fit these cases at the earliest possible age with any appliance which they have to wear.

The PRESIDENT said he had been impressed with the frequency with which the femur was abnormal; such cases were often being shown.

Congenital Scoliosis.—M. W. BULMAN, M.S., F.R.C.S.

Boy, aged 8 years.

Has had deformed back since birth. There is a marked lateral curvature in the dorso-lumbar region which cannot be corrected. Skiagrams show only a half twelfth dorsal vertebra on the right side with a twelfth rib on the left side.

The child is mentally very defective but there are no other congenital defects.

The PRESIDENT said that Dr. Abbott, who had a reputation in regard to the use of appliances for scoliosis, had stated a few years ago that every case of congenital scoliosis became worse, and for that reason he carried out bone-grafting in these cases. He (the speaker) however did not agree with him and told him so. Mr. Tyrrell Gray had a case with a half vertebra in the lumbar region, and he inserted a bone strut across the curve. He saw

the case some time afterwards; the strut was there solid enough and the curve too. He (the President) had always been content, if he did anything, to make a plaster bed and order a jacket of some kind, particularly in the case of younger children who were growing fast.

Persistent Pyrexia: (?) Still's Disease.—H. J. STARLING, M.D.

Girl, aged 15.

Admitted to hospital in April, 1928, with a history of two years' persistent pyrexia, varying from 99° F. to 104° F. during most of this time, accompanied with swelling and pain in nearly all the joints of the body and limbs, and cardiac symptoms which gave rise to the diagnosis of infective endocarditis.

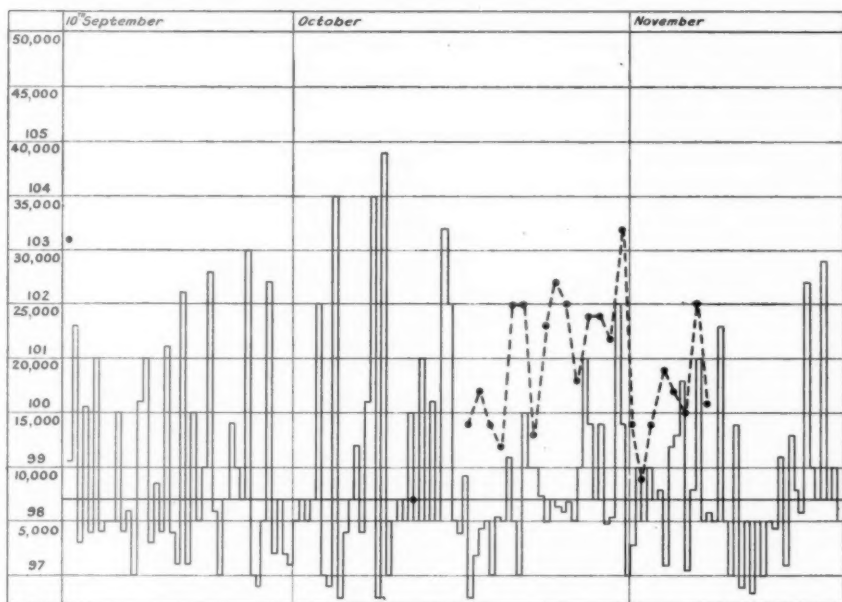


CHART (DR. H. J. STARLING'S CASE OF PERSISTENT PYREXIA).

This graph is constructed from the 8 a.m. and 8 p.m. temperatures of the 4-hourly chart from the day of admission in September, 1929. The patient remained in hospital for about 8 weeks after the date on which this graph ends, and during this period the temperature remained at a much lower level, 97 to 99.6° with only occasional higher excursions. The graph also represents the type of pyrexia which was present during the greater part of her 7 months' stay in hospital, in 1928, and during her present admission (1930).

The continuous lines represent the temperatures. The isolated dots early in September and October refer to the leucocyte counts on two separate occasions; the dots later on, connected by interrupted lines, denote the leucocyte counts taken every morning.

The figures on the left of the chart from 97 to 105 denote the degrees of temperature, and from 5,000 to 50,000 represent the number of white cells per cubic millimetre.

On admission the patient looked pale and ill; her head was bent forward, owing to fixation of the cervical vertebrae, and her mouth could only be opened to three-quarters of an inch, even under an anæsthetic; the left wrist was completely ankylosed and there was stiffness with limitation of movement in the wrist, elbow, knee and ankle-joints.

She remained in hospital seven months, and during the early part of the time, the temperature, which was usually between 97° and 99° F., used to shoot up precipitately to 103° and 104°. The tonsils were removed with difficulty and the child was treated with a polyvalent anti-rheumatic vaccine and intramuscular peptone injections.

She was discharged immensely improved and remained so for some considerable time.

She was readmitted in September, 1929, having relapsed during the preceding three months. Her joint condition had maintained its improvement, free movement being obtained in the joints of the legs, but there was still some limitation of movement of the wrists and elbows.

On her first admission a white-cell count of 15,600 was noted, but on September 10 the white-cell count was 32,499. The temperature still showed periods of apyrexia, broken by sudden rises to 104° and 105° F., and the white-cell count varied between 56,400 and 7,400. A daily chart was kept of the white-cell count and of the temperature, but it was found that the increase of the former had no relation to the increase of the latter. Blood-culture proved sterile; examination of faeces and urine showed no abnormality, and full investigation of the tonsil-beds and of the accessory nasal sinuses showed no evidence of focal infection. The patient was treated by protein shock, Dmelcos being the agent used, and she was discharged in January, 1930, considerably improved, the temperature for two weeks not having been above 99·4° F. (see chart). A later account shows that she has again relapsed. The spleen has not been palpable at any time.

Dmelcos is a substance used for the production of protein shock. I first saw it used at the Norfolk Mental Hospital as a substitute for malaria inoculation in the treatment of general paralysis of the insane. It is a dead culture of a streptococcus obtained from a soft chancre. Given intravenously in graded doses, it causes a rise of temperature and generally a rigor, but the reaction is limited to 24 hours and the temperature remains normal afterwards.

Discussion.—Dr. F. J. POYNTON said that there was considerable difficulty in treating these cases. As an example, a child aged two and a half years was brought to hospital because of what were thought to be rheumatic pains in the knees. As the tonsils were enlarged they were expertly nucleated. A few weeks later multiple arthritis developed, followed by pericarditis, without a valvular lesion. The case was now under his (Dr. Poynton's) care. There were attacks of continued fever and the repeated occurrence of a rash: this was called an "allergic phenomenon." Then the glands and spleen became enlarged: the swelling disappeared and then recurred. There was now a rapid heart, without a murmur, and the child was drifting into rheumatoid arthritis. He thought that cases of Still's disease, especially those on the border line, would teach more about rheumatism than would any other kind of case. Did the child in the present case live in a damp place?

Dr. STARLING (in reply) said that he had not seen the patient's residence, but her condition relapsed whenever she returned home.

Bilateral Brachial Plexus (Lower Cord) Lesion due to Cervical Ribs.—
B. MORGAN, M.D.

Boy, aged 11 years. Weakness of both hands for three years. Both hands and the lower third of the forearms are blue and cold. The small muscles of both hands are wasted and claw hand is present in both, but much more marked in the left than the right. Abduction of the fingers is impossible in the left hand, but can be carried out in the right. No sensory disturbances, tactile, painful or thermic.

Skiagrams show a definite rudimentary cervical rib on the right side, and an enlarged transverse process of the seventh cervical vertebra on the left.

Neither the rib nor the elongated transverse process can be palpated. There is a subluxation of the left sterno-clavicular joint.

I think it is unusual for bilateral symptoms to be caused by cervical ribs. The worse hand is on the side opposite to that on which the rudimentary rib is situated, i.e., on the same side as the enlarged transverse process, which favours the point of view that it is not the pressure of the rib which causes the symptoms, but rather the fibrous band which occasionally runs from the rudimentary rib or the enlarged transverse process, or even a normal transverse process, down to the first thoracic rib. I think this case should be dealt with surgically. I have had the boy under observation for eight months, but I have not yet consulted a surgeon because I wanted to know what those at this meeting would think of the case. I should like to know whether the symptoms are due to the abnormalities in the transverse processes, and whether surgery is indicated.

Discussion.—The PRESIDENT asked whether Dr. Morgan knew of any other case in which cervical ribs had caused symptoms in childhood; he did not think there could have been many such cases. He had seen a great many cases of cervical ribs and congenital scoliosis in children, but in only one had symptoms apparently resulted. That was in a girl, aged 10 years, whose mother had had a cervical rib operated upon because of wasting of the thenar eminence. That girl had signs on both sides and enlarged seventh-cervical processes, though not so marked as in the present case. On exploring one side he had not found anything worth recording and the procedure did no good. The general experience was that the wasting was more difficult to cure than the pain and other symptoms. In that case there was no band; the band in these cases was, he thought, the margin of the scalenus medius passing on from the cervical rib to the first rib. In the case to which he had referred the final diagnosis was progressive muscular atrophy. There seemed to be nothing in this present case to support that diagnosis.

Dr. WILKIE SCOTT said that he had under his care a younger boy who had come with similar symptoms, and there was wasting of both the thenar and the hypothenar eminences on one side. Skiagrams showed a double cervical rib.

Mr. ERIC LLOYD said that at Great Ormond Street Children's Hospital he had a similar case in a boy, and it was the only case he remembered in which symptoms seemed to be due to a cervical rib. Subsequently, Dr. Poynton had diagnosed syringomyelia. The President's scepticism was thoroughly justified and operation in children must be very rarely called for.

Dr. F. J. POYNTON agreed as to the rarity of such symptoms in a child being caused by cervical ribs. In a long experience with children he had not met with such a case, though that did not mean that such cases did not exist. In the absence of pain, he would conclude that operation was not likely to do good.

Dr. MORGAN (in reply) said that even on a hot day the boy's hands were cold and "beefy" as if there were vascular changes, such as he did not think occurred in progressive muscular atrophy. If the condition was one of progressive muscular atrophy, it would probably come into the Charcot-Marie-Tooth category, in which there was a definite hereditary factor. In this case there was no evidence of heredity, and he (Dr. Morgan) had been unable to find nervous changes or lesions in the lower limbs.

Bilateral Congenital Coloboma of Uveal Tract.—G. MAXTED, F.R.C.S.

Doris T., aged 10 years. Condition found in the course of routine examination of children at the school clinic.

Right eye shows a coloboma of iris and choroid, and a coloboma of the disc separate from that of the choroid.

Left eye shows a coloboma of iris, choroid and optic disc all continuous, and it is difficult to see where the disc actually is.

The child is myopic, and vision, with correction, is $\frac{6}{10}$ in the right eye and barely $\frac{6}{20}$ in the left.

Celiac Disease.—H. J. STARLING, M.D.

Boy, aged 11½ years. Healthy at birth; began to dwindle at 9 months when weaned. Treated in St. Thomas's Hospital from the age of 1 year and 6 months to that of 2 years and 6 months. "A perfect skeleton." Improved on going to live at Yarmouth, but stomach always big and motions always loose.

In January, 1924, had attacks of tetany. In August, 1924 (then aged 6) looked about 3 or 4 years old; height, 3 ft. 3½ in.; weight, 2 st. 8¾ lb.; girth round umbilicus, 26½ in.; abdomen huge with general distension. Was then given diet limited as to fat.

June, 1925, admitted Norfolk and Norwich Hospital. Height, 3 ft. 4⅞ in.; weight, 2 st. 8 lb.; abdominal girth, 23½ in. Stools very bulky, normal in colour, less offensive, contained large amount of fatty acid crystals and undigested muscle fibres.

Put on fat-free diet and maintained on this for the next four years, by which time he was going to school and playing games.

11.6.30: Aged 11 years and a half. Height, 4 ft. 4½ in.; weight, 5 st. in clothes; abdominal girth, 24½ in.; chest expansion, 23 to 25½ in.

Has won a scholarship at the Grammar School—plays all games, is in the Cadet Corps. Takes eggs, meat, chicken, fruit, vegetables, biscuits, rice pudding and corn-flour made without milk; no fats.

27.11.26.—Total fat in faeces, 62%, of which neutral fats = 24%, fatty acids, 38%. 11.6.30: 12%, of which neutral fats = 8%, fatty acids, 4%.

Discussion.—The PRESIDENT asked whether the fat-free diet was maintained strictly for four years. One of the first cases that he had seen was one in which, after Dr. Still had ordered a diet similar to that in this case, he was surprised to find that it produced an extraordinary form of rickets, and Dr. Still was inclined, at that time at any rate, to think that this was due to his diet and not to the disease.

Dr. STARLING (in reply) said that the child had had symptoms of rickets when first seen, and he was then having ordinary diet. The boy's mother was very intelligent, and was probably carrying out the instructions as to diet. The boy had fractured his leg playing at football, and the fracture had healed without trouble. He was now having one egg a day, but no other fats.

Dr. ERIC PRITCHARD said that he questioned whether the absence of fat *per se* was of very great importance in maintaining nutrition. Was it not more probable that in fat starvation it was the absence of fat-soluble vitamins that caused the trouble? If so, that was a dietary deficiency which was easily rectified without supplying undue amounts of actual fat. He treated his celiac cases on a practically fat-free diet, but he saw that the patients had plenty of fat-soluble vitamins from other sources, and no wasting or other symptoms developed under such circumstances. It was easy to give cod-liver oil, carotin, and other concentrated forms of vitamins. One manufacturer was using a tasteless concentrate of fat-soluble vitamins to reinforce his margarine, and he (Dr. Pritchard) had used this in cases of celiac disease. Nobody could treat celiac disease on an absolutely fat-free diet, but with any serious deficiency of fat-soluble vitamins there were always bony and rickety changes. It was a good plan to give oleo-fat (the liquid fat expressed from beef-suet), as that contained both fat-soluble A and B vitamins in satisfactory amounts.

Congenital Constrictions on Leg and Arm.—M. W. BULMAN, M.S., F.R.C.S.

Boy, admitted to hospital on account of congenital talipes of the right foot, which has been treated by tenotomy and circiform tarsectomy without improvement. There are two circular constrictions, one on the right leg and one on the right arm; these have been present from birth.

I began to treat the case by wrenching and plaster, but the treatment did not give permanent benefit, so I performed a tenotomy of the tendo Achillis and the

anterior and posterior tibials. The condition relapsed soon afterwards, and then I performed tarsectomy. This corrected the defect somewhat, but was not very satisfactory. The boy now wears a surgical boot, with a double iron below the knee. He lives forty miles from Norwich, and it is difficult to keep him in hospital for a sufficient length of time to prevent relapse. The trouble is said to be due to pressure of the umbilical cord, but I do not see how a cord can cause several constrictions each being a complete circle. The condition is certainly congenital.

The PRESIDENT said that he too had been sceptical about these constrictions and congenital amputations being caused by pressure of the cord until one of the resident obstetric physicians at King's College Hospital had shown him a fetus recently delivered in which the toes were tied up in strands and adhesions, amniotic bands being wound round the toes.

Hirschsprung's Disease Treated by Rectal Tube.—Y. H. BLAKE, M.B.

Girl, aged 6 years. Admitted to Great Yarmouth Hospital March 15, 1927, with a history that when eight days old she had a "stoppage" and vomited faeces. Relieved by castor oil. Always constipated. Bowels not open for five or six days, then a large offensive motion was passed. Passage of flatus very noticeable.

Appearance on Admission: Enormous ballooned abdomen, marked emaciation. One very large tense coil of intestine could be traced from right to left down and across the abdomen. A tight sphincter, and a ballooned rectum containing some faeces could be felt *per rectum*.

Treatment.—A small flanged empyema tube was inserted into the anus at night and tied by tapes to a belt; this was left in for twelve hours and removed for the day. After two days abdomen became flaccid and circumference reduced 6 in.

Hypodermic injections of eserine, 3000 gr., and pituitrin, $\frac{1}{4}$ c.c., were given every night for five months, followed by an enema and wash-out in the morning.

January, 1928, discharged strong and well. Daily enema continued for one year, since when the bowels have functioned normally.

Dr. STARLING said that he had read a paper in which the condition was attributed to an achalasia of the sigmo-rectal sphincter. In one of the cases quoted, a Barnes bag had been inserted high up the rectum and blown up in order to dilate this sphincter. The child now shown had worn the tube every night; flatus was passed through the tube, but the bowels were not emptied except by enemata for a year afterwards. Later there was a great reduction in the size of the abdomen and a very considerable improvement in the general condition of the patient.

Professor Fraser, of St. Bartholomew's Hospital, had recently shown a case to him (the speaker) in which complete abdominal sympathectomy had been performed for a similar condition.

Hirschsprung's Disease.—B. MORGAN, M.D.

Boy, aged 6 years. Constipation and distended abdomen since birth. Previous to admission one or two weeks would elapse without action of the bowels. While patient was in hospital in 1927 the abdomen was greatly distended, and there was marked visible peristalsis. The stools were bulky, not offensive, normal in colour and not greasy. Apart from the abdominal condition the child is healthy.

Now at the Norwich Infirmary; daily relief of bowels obtained by colon wash-outs.

The abdomen is full; a large sausage-shaped mass can be felt from left iliac fossa to left hypochondrium, extending to the right of the mid-line at the level of the umbilicus.

Barium meal + enema shows a huge dilatation of the colon.

Congenital Heart Disease.—H. J. STARLING, M.D.

Boy, aged 8 years.

At age of 6 weeks had epistaxis, which recurred at intervals until he was 3 years old; since then more frequently. The epistaxis is very severe and difficult to control, necessitating complete rest in bed for three or four days. In the intervals he has played games at school, but is very short of breath. He is an only child.

The heart is much enlarged; the apex beat is in the sixth space in the anterior axillary line. At the apex there is a loud systolic blow transmitted to the right of the lower sternum. At the third left interspace there is a harsh systolic rumble, followed by a second heart-sound, which is followed by a diastolic blow. These sounds are transmitted chiefly upwards and to the left. Rhonchi can be heard in both lungs. Face flushed; eyes prominent.

It is suggested that pulmonary stenosis and regurgitation are present.

Bilateral Congenital Dislocation of Lens.—G. MAXTED, F.R.C.S.

Margaret C., aged 5 years and 11 months. Brought for advice six months ago, because she held objects so close to her eyes. Each lens showed a partial dislocation and a well-marked lamellar cataract.

The right eye was needled on two occasions five months ago; the lens is now mostly absorbed, leaving a clear area in the outer half of the pupil; for the last three weeks she has been wearing a correcting lens for this eye.

Athetosis in a Boy aged 4 years.—B. MORGAN, M.D.

May, 1928.—The mother noticed that the child did not use the left arm, and that on attempted movement the limb became stiff, and bent at the elbow and wrist with the fingers stiffened and spread out. The condition gradually improved and now is nearly normal.

March, 1929.—Similar condition began in the right arm and has continued since.

No difficulty in walking, but in August, 1929, speech appeared affected, i.e., seems to "keep his lips stiff, and sometimes fluid will dribble out of right corner of mouth."

Normal birth. No convulsions in infancy, no illness of any kind preceding present condition.

On attempted movement, the right arm becomes pronated, flexed at the elbow and wrist, with hyperextension and abduction of fingers. When the child's attention is distracted the muscular rigidity passes off. The mother states that during sleep the limbs are quite limp. When running, the right arm, and to a less marked degree, the left, is held to the side, elbow and wrist flexed. Child talks well. Intelligence good. All reflexes normal; plantars sometimes extensor—usually flexor. Second and third toes on both feet are webbed. Winging of both scapulae, left more marked than right. Wassermann reaction doubtful.

Has been treated with belladonna and hyoscine without improvement, and is now being treated with dried stramonium.

Cretinism in a Girl, aged 14 years.—B. MORGAN, M.D.

This child was taken to a doctor when 3 years of age on account of "backwardness" and was given tabloids (probably thyroid) for one year.

Eldest of three children, other two healthy. Child is unable to talk, walk, or stand. Complexion—waxy-yellow, broad alae nasi, tongue protruding from mouth. First teeth still in upper jaw, the right central and lateral incisors being second teeth. Skin dry, hands and feet blue and cold. Hair dry and lustreless; scalp, on admission, covered with large dense plaques of seborrhœic material. Small

umbilical hernia. Height 36 in., weight 2 st. 4 lb. 11 oz. No thyroid gland can be felt. Skiagrams show that the heads of the femora and humeri have failed to ossify. In the skiagrams of the latter, ossification centres can be seen.

Cretinism in a Child, aged 2 years.—B. MORGAN, M.D.

After an unsuccessful attempt to repair an umbilical hernia in January, 1929, the child was noticed to be backward, no teeth appeared, and she did not attempt to walk or talk. Later, seen by Dr. Chodak Gregory and given thyroid. The umbilical hernia was then repaired, a thyroid graft being at the same time inserted, which, however, did not "take."

The child, who still retains the cretinoid appearance, is steadily improving, has cut some teeth, tries to stand and can say a few words. She is now taking half a grain of dried thyroid extract twice daily.

Discussion.—Dr. CHODAK GREGORY suggested that this case had better have another trial, to see whether the thyroid graft had taken. The treatment was continued for a month and then stopped for a month or two. In the latter period the child retrogressed, so much that she (Dr. Gregory) thought the graft had not taken. She believed there had been successful results from thyroid grafts. This patient had had fresh thyroid grafted from a patient on whom Mr. Joll was operating. It had been put partly into the abdominal cavity and partly under the skin.

Dr. ERIC PRITCHARD said that at first sight he had taken this to be a case of congenital short neck with absence of some of the cervical vertebræ, but, on further examination, he thought that the normal number of vertebræ were present, though the chin was pressed right down on the sternum. He wondered whether this feature would interfere mechanically with the development of the thyroid.

Hypothyroidism.—B. MORGAN, M.D.

Girl, aged 2½ years, shown for comparison with the two cretins.

On admission (two months ago): Mentally dull, pale facies, broad alæ nasi, hair thin and lustreless. Tongue slightly protruding from the mouth.

Under treatment with thyroid, gr. 1½ daily, her colour has become bright, she can stand up when holding on to the sides of her cot, and her mental condition has much improved.

Congenital Atresia of the Ileum. Specimen.—B. MORGAN, M.D.

Female infant, aged 4 days, admitted on account of intestinal obstruction, no meconium having been passed since birth.

On admission the abdomen was distended, and there was well marked ladder-pattern peristalsis. A finger could be passed only for a distance of about two inches up the rectum when it met with what appeared to be a cul-de-sac.

At operation a greatly dilated small gut was found ending in a blind sac which was continued as a very narrow cord. A tube was inserted into the end of the dilated gut which drained well until death, which occurred the next day.

The specimen shows that the distended blind end of the small intestine is about 6 in. above the appendix, the narrow portion joining the distended to the non-distended gut being about ¼ in. in length.

The rectum was bound down by peritoneum in such a way as to be acutely kinked.

Achondroplasia in a Child, aged 4 Years.—B. MORGAN, M.D.

The mother noticed that the child when aged 4 months, was unable to sit up, and had a "curved spine." Did not cut teeth until 3 years of age.

No other abnormal members of the family are known.

Length, 27 in.; weight, 1 st. 4 lb. 2 oz. Unable to talk, walk, stand, or sit up.

Limbs short in proportion to trunk. Upper arm short in proportion to forearm. Scapulæ small. Marked furrowing of limbs.

Joints: Restricted extension of elbow. Abnormal mobility of knee-joints.

Hands: Well marked, "Trident hands."

Trunk: Slight beading of ribs. Spine: Dorsal curve exaggerated; when child is held up there is a lordosis which is exaggerated by the prominent buttocks.

Skull: Brachycephalic. Anterior fontanelle closed. Bridge of nose depressed.

Skiagrams show deformity at the epiphyseal ends of the long bones, whilst the fibulæ are nearer the knee-joint than normal.

Section of Orthopædics.

[May 6, 1930.]

Three Cases of Congenital Œdema (Milroy's Disease) in Two Generations of the Same Family.—E. LAMING EVANS, C.B.E., F.R.C.S.

A. F., female, brought at age of six months with œdema, limited to the dorsi of the feet, observed shortly after birth. The œdema has extended upwards so that now, when the patient is aged 2 years, it reaches to the middle of the lower part of the legs. It pits on firm pressure; there is no pain, tenderness, or discoloration.

Massage fails to disperse the œdema, which is persistent after prolonged horizontal rest.

Urine normal. There is no demonstrable lymphatic or venous obstruction, or any evidence of endocrine dysfunction.

F. F., aged 30, the father of A. F., presents a firm œdema of the left foot and leg extending to the middle of the lower leg. It was noticed shortly after birth and is constant day and night. It causes very little inconvenience, and the patient can walk fifteen miles.

G. F., aged 55, the grandfather of A. F., has a firm œdema of both feet and legs extending to the middle of the lower leg; it was observed shortly after birth.

He is still able to play tennis, and suffers little inconvenience from the œdema.

No constitutional symptoms or intercurrent acute attacks have been observed in any of these three patients, whose mentality is about normal.

Discussion.—Mr. ROCYN JONES said that a case which he had shown at a meeting of the Section for the Study of Disease in Children, differed from this present case in that no family history of the condition had been obtainable. The patient was a child, aged 9, and both lower limbs, from the knee downwards, were œdematous. The urine was tested, and blood analysis made, but every result was negative.

He found, on looking up the literature, that Kondolón, in 1912, had suggested an operation, namely, stripping fascia from the great trochanter to the external malleolus. A similar operation had been performed by Mr. Clayton Green, not for this condition, but for idiopathic elephantiasis, which resembled this disease. Mr. Green had carried it out in two cases, but it was not a success. One or two other surgeons had performed it, but though some improvement occurred immediately afterwards, this did not last.

Milroy published his first paper on the disease in 1892, and had had the opportunity of following up a large number of cases in America; some of the patients held important posts, their only inconvenience being the swelling of the lower limbs, for which they applied elastic bands or stockings.

In the case which he (the speaker) had shown, he had tentatively suggested Kondolón's operation, but as no physician had supported the suggestion, he had not persisted. He had periodically seen the child, who was just like other children; he attended school and enjoyed life generally. He had had regular massage for three months, and that had dissipated the œdema, which disappeared in the night and only reappeared towards the end of the day. Massage, however, had had no lasting value. The Wassermann reaction was negative.

Mr. W. H. OGILVIE said that possibly Mr. Laming Evans had read a paper by Dr. Arnold Osman in the *British Medical Journal*, 1930, i, 780. Dr. Osman had been investigating nephritis for many years, and had found that most of the cases were characterized by water retention in the tissues, and that there was a diminution of blood alkalies. The paper in question referred to puzzling cases of œdema of the feet in young women, in which

investigations produced only negative results; there was normal urine and a normal heart. After treatment with alkalies the œdema disappeared. He (the speaker) had sent several patients to Dr. Osman and they had been cured by alkaline treatment. He did not think this treatment had been carried out in Milroy's disease.

The PRESIDENT said he had been waiting for a case in which he could perform Kondolœon's operation. He believed that the successful cases in America had been unilateral. Kondolœon had introduced it for traumatic elephantiasis, in which there was some condition, either inflammatory or traumatic, blocking the lymphatics of one limb. His own attention had been drawn to the condition by a patient who consulted him in London some years ago because of an enlargement of one lower limb; it was the asymmetry which worried her. She went to the Western States, where she had a Kondolœon operation performed, and apparently it was successful.

Cyst of Synovial Membrane in the Region of the Internal Semilunar Cartilage.—R. C. ELMSLIE, M.S.

The patient is a man, aged 36, who, before I saw him, had been treated for five years for arthritis of the knee. There was pain, which became worse at night, but he never had locking or mechanical symptoms. The swelling was said to vary in size from time to time. I opened up the knee on the inner side and removed the



Synovial cyst of the inner side of the knee.

cyst, with the greater part of the internal semilunar cartilage. Incidentally, in removing it I found that the posterior part of the cartilage was split longitudinally. It will be seen that the cyst is not in the cartilage, but is in the synovial membrane in the neighbourhood of the cartilage. The specimen will be placed in the Museum of the Royal College of Surgeons.

Discussion.—Mr. WATSON JONES said that in two of his thirteen cases of cystic cartilages there had been a tear in the posterior horn. He thought he had himself made these tears while removing the cartilages, but he might not have done so.

Mr. ELMSLIE, in reply, said he felt fairly sure that the tear had been present before he undertook the operation. He made a vertical incision on the inner side of the knee, just in front of the internal lateral ligament, avoiding damage to the posterior half of the capsule on

the inner side. The cystic change was in the synovial membrane, and the cyst projected beyond the normal contour of the joint.

Recently he had operated upon an external cartilage on which there was a swelling in front of the external lateral ligament, and he had thought that there would be a cyst of the cartilage, but he had found a thickened mass, and the cartilage was not cystic. On investigation he had found a split, as in the present case, leading to a spicule of bone. He thought there had been some injury to the cartilage which had allowed a portion of the margin to be pushed laterally outside the joint line, and so to become enlarged and thickened.

Two Cases of Paraplegia Associated with Scoliosis.—A. H. TODD, M.S.

(I) E. H., a girl, aged 16 years, admitted to hospital November 13, 1929, transferred from East London Hospital for Children, where she had been under the care of Mr. Acton Davis.

History.—Anterior poliomyelitis at age of 9 months; treated at various hospitals; in-patient for six months in 1927. Has worn jacket since May, 1929. Never been able to use right leg properly. Power has been decreasing during last five months. Could walk until a week ago, when right leg became completely useless and she had "pins and needles" in left leg. No incontinence.

Condition on Examination.—Severe scoliosis; convex to left. Right leg, flaccid paralysis. Left leg spastic and left knee-jerk much increased. November 15, 1929.—Right leg now spastic. Both plantar reflexes extensor. Skiagram shows kypho-scoliosis, especially D3-D9.

November 23, 1929.—Dr. Muir notes: "Sensation decreased in both legs, on left side, to level of umbilicus, and on right side to about anterior superior iliac spine."

November 29, 1929.—Dr. J. P. Martin notes: "Left leg: Complete spastic paralysis with loss of sense of position and partial loss of sensation to pin-prick to upper level of L2 distribution. Right leg: Old poliomyelitis with deformity and poor development; now some spasticity of extensor plantar reflex; sense of position present. Maximum pressure on cord is at level of L2 segment (=D11 spine). There is certainly no severe pressure above this level."

January 24, 1930.—Treatment by suspension begun.

February 21, 1930.—Suspension for one hour, four times in the day.

March 10, 1930.—Suspension for one hour and twenty minutes, four or five times a day. Left leg: No voluntary movement; ankle clonus; knee-jerks increased. Right leg: Flexor spasm, loss of movement, spasticity increasing.

The question is what should be done for this patient, as the condition has become worse, despite the treatment by suspension. She is of poor physique, and laminectomy would be a very serious undertaking in her case: I would shrink from performing it. Dr. Martin says he supposes that the onset of the paraplegia is associated with the secondary development of the vertebral column at puberty. How the spinal cord is affected in these cases is, Dr. Martin says, not known, but apparently the scoliosis interferes with the circulation. This seems to me the most acceptable explanation.

(II) F. B., aged 45. Transferred August 27, 1929, from the London Hospital. Complete paraplegia and incontinence.

Previous History.—"Sciatica" in 1919. This was followed by left foot-drop which has persisted ever since.

History of Present Condition.—In May, 1929, noticed difficulty in emptying bladder, followed shortly afterwards by incontinence of fæces. Also noticed that his knees were liable to give way. Admitted to the London Hospital by Dr. George Riddoch. He walked in.

Condition on Examination.—Pupils normal. Plantar reflexes flexor. Knee-jerks both present, right obtained with re-inforcement. No clonus. Kypho-scoliosis severe. Marked sweating of both feet.

Wassermann reaction: Blood, negative; cerebrospinal fluid, not obtainable.

September 20, 1929.—Dr. J. P. Martin reported that the signs indicated interference with conduction at the first lumbar segment and also disturbance of the left side at the level of L5 and S1. Dr. Martin suggested that there might be a vertebral abscess secondary to tuberculosis of the spine.

September 25, 1929.—X-ray examination: Some irregularity of bodies of vertebræ D9 and L1, but no collapse or loss of substance.

October 3, 1929.—Incontinence gone. November 12, 1929.—Suspension treatment begun. December 29, 1929.—Smarting sensation in right leg. January 8, 1930.—Voluntary movement of toes. March 8, 1930.—Can now take five periods of suspension a day, each lasting an hour and a half. April 23, 1930.—Walking. Plantar sensations normal. Power in right leg increasing.

Discussion.—Mr. R. C. ELMSLIE said that he had seen six cases of paraplegia, with scoliosis. One, which he brought before the Section several years ago, was in a boy, who had severe dorsal scoliosis and complete motor and sensory paraplegia up to the level of the fifth or sixth dorsal segment. Lipiodol was injected, and was blocked above and below the level of the lesion. He (the speaker) performed laminectomy, and inspected the whole interior of the canal and saw the backs of the bodies of the vertebræ, but could not find any sign of disease or abscess, or of pressure on the cord. The cord, however, was under great tension. It was a feasible suggestion that the paraplegia, associated with scoliosis, was due to interference with the blood-supply. One of the other cases was a congenital scoliosis with wedge-shaped vertebræ in a patient whom he had first seen in St. Bartholomew's Hospital some years before. He saw him again when he was in the National Hospital, Queen Square, under the care of Dr. Collier, and he then had paraplegia. He (Mr. Elmslie) had treated four cases by suspension for as long periods each day as they could stand. The first case had begun with complete paraplegia; there was no voluntary movement, and there was complete anaesthesia to level of the fifth dorsal nerve. There was considerable improvement; the anaesthesia all disappeared and some voluntary movement became possible. At the end of a year the patient was walking about with a spastic gait.

His (the speaker's) only suggestion with regard to Mr. Todd's first case was to continue the suspension treatment.

The second case was difficult to explain. The scoliosis was too low down to be a cause of paraplegia; in the cases which he had seen, the scoliosis was well up in the dorsal region. The skiagrams of the spine in this case were puzzling.

Mr. G. R. GIRDLESTONE said that he gathered that the girl did not bear suspension very well. Continuous head and limb traction could be carried out by tilting up the bed and allowing gravity to do most of the work, putting 5, 3 or 2 lb. weight on the head. That method was less severe than suspension.

The PRESIDENT said he, like Mr. Elmslie, considered that non-tuberculous scolioses were more often associated with high dorsal scoliosis. He had no experience of intermittent suspension; he put these patients on an Abbot's frame, with an improved twisted jacket used as a pad. He found that these cases did not do well afterwards, as it was difficult to support the back above the sharp angle. He agreed with Mr. Elmslie that the pressure of the back of the body was the worst factor in the pressure on the cord; hence removal of laminae did not always give relief, and straightening out of the spinal column—if that was possible—did.

Specimen of Internal Semilunar Cartilage as a Complete Disc.— R. WATSON JONES, F.R.C.S.

A man, aged 34, for several years had noticed a clicking on the inner side of his knee. There was no clear history of injury, except a few minor strains. There was elastic resistance to the terminal 10° of extension, and the joint made a click on manipulation. The cartilage was easily removed. Is this a simple bucket-handle tear of the cartilage, sustained at some unknown period of the patient's history, which has become rounded in the course of years and hypertrophied, or is it a



Internal semilunar cartilage in the form of a complete disc. The ridge near the anterior horn is due to clamp used in removal.

congenital anomaly, a reversion to the type of cartilage which is constant in the chimpanzee? In all the three analogous cases which I have seen, it was the external cartilage which was involved, and the cartilage was a disc, not a circle with a central perforation.

Mr. R. C. ELMSLIE suggested that this was a case of old injury to the cartilage, split round the margin, which had been displaced inwards and had undergone secondary changes. In the disc cartilages which he had seen in the external cartilage, the part which came to the centre of the joint was thin and translucent.

Pathological Dislocation of the Hip-joint.—R. WATSON JONES, F.R.C.S.

Patient, a girl, aged 3 years, had a six weeks' history of pyæmic multiple arthritis of both elbows, wrists and hip-joint. Both hips were flexed and adducted, and one of them was dislocated on to the dorsum ilii and the epiphysis was displaced off the neck of the femur (fig. 1, p. 70). Whilst this hip was being manipulated under anaesthesia the other hip dislocated. Both dislocations were reduced and the hips brought into position and two plasters were applied. In the skiagram taken a week or two after coming out of the plaster, the head and neck of the right femur had completely disappeared. Now, twelve months later, the child is walking with a leather spica and both hips are freely movable (fig. 2). On the right side, despite destruction of the head and neck, there is free articulation with the acetabulum.

In these cases of destructive arthritis in infancy, it is still possible to keep a stable hip if it is reduced early, and to avoid the femur riding up on the dorsum ilii.



FIG. 1.—Pathological dislocation of the hips, six weeks after onset of acute pyæmic arthritis. (Skiagram by Dr. R. E. Roberts.)

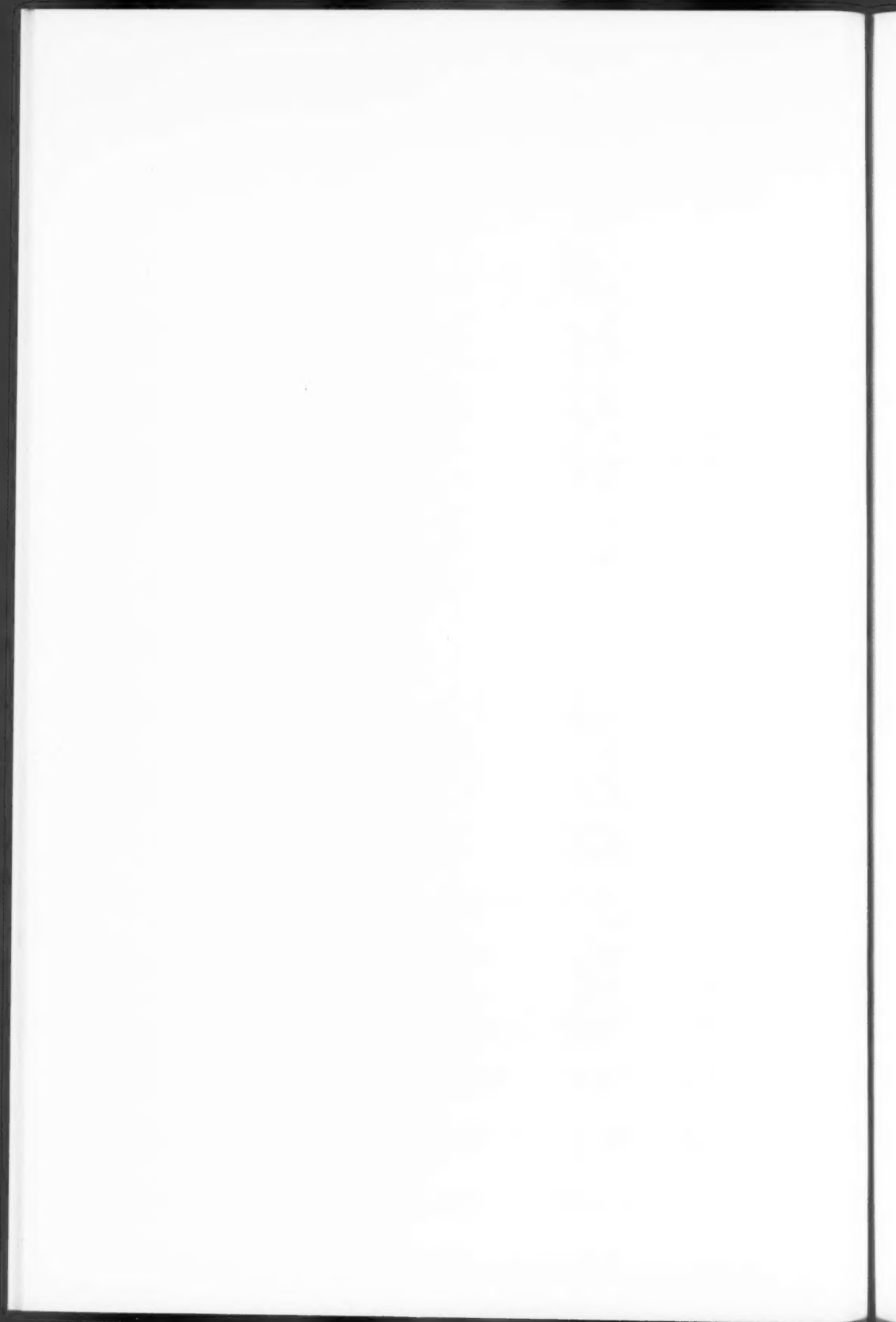


FIG. 2.—Same case eighteen months after manipulative reduction of both hips. There is complete regeneration on the left, and on the right, despite complete destruction of the head and neck, a stable, movable hip. (Skiagram by Dr. R. E. Roberts.)

Can the stability of the right hip be increased? Vertical osteotomy, splitting the piece of trochanter outwards and reconstructing a neck from the upper shaft, and in this way putting the gluteal muscles into normal relationship to the femur, might answer.

Discussion.—Mr. W. H. TRETHOWAN said that he had always failed to reduce such pathological dislocations by closed manipulation. Reduction was possible at open operation after the division of a mass of fibrous tissue.

The PRESIDENT said that he would not at present attempt to further stabilize the right hip as it might turn out in the long run to be sufficiently stable. He would keep the leather spica on for a long time; he had obtained a good result by so doing in one or two cases.



Section of the History of Medicine.

[April 2, 1930.]

Two Sixteenth-Century Veterinary Books.

By TOM HARE.

(1) *Dis Büchlin sagt wie man pferd artzugen und erkennen soll.*

AUTHOR unknown, dated 1502, printed in black letter by Mathis Huepfuff, at Strassburg, a woodcut of whose device is borne on the last full page (fig. 1). (The only copy of this book cited by Schmidt, *Répertoire Bibliographique Strasbourgeois*, is in the Dresden Library.)

The first page bears the title above a woodcut which is repeated overleaf (fig. 2). It appears to represent a farrier examining the mouth of a saddled horse which is tied up to his stocks. The farrier wears a leather apron, on the front of which a firing-iron is slung. The mediæval castle in the background may be the residence of the nobleman who is watching the examination of his horse.

The subject matter occupies sixteen double pages, and the index five single pages. The first four pages deal with the points of a good horse, its colour, make, shape, etc. Then follow in the conversational style common to the time, pages of prescriptions for a series of maladies:—

Leaf iv. Diseases of the eyes, epiphora, cataract, pus in the eye, film over the eyes (? the haw which used to be removed as a blemish, *vide* Smith) [1], swollen throat.

Leaf v. Swellings over and under the belly, abscesses, bruises, "siechtagen des magens" (? stomach sickness), stomach worms.

Leaf vi. Worms (which are described as "pointed").

Leaf vii. Flatulence (tympantitis), lameness, wounds of the foot, contracted foot.

Leaf viii. Disease and growth of the hoof, sandcrack, swollen legs, nail in the foot.

Leaf ix. Over-reach, broken-wind, splints (exostoses), ileus, retention of urine, diarrhoea, dressing for the umbilical cord.

Leaf x. "Kellsucht" (disease of the larynx), spavin, strangury (possibly confused with strangles, *vide* Smith), proud-flesh, suppuration, pus in the foot, hydrops articuli or windgalls, skin dressings, scurfy skin.

Leaf xi. Mange, polyuria, galls or sores of the mouth, arrow wounds, injury and paralysis of the tail, wounds.

Leaf xii. Breathlessness, adiposity, "gursay" (? gerste = laminitis), cramp, sore-back, "mort" (? staggers or vertigo).

Leaf xiii. "Schale" (? schule = lampas), "hustrauch" (? cough), drooping ears, beetles (? bots) in the stomach, grease.

Leaf xiv. Maggots in the ear, "magenpissig" (? watery stomach), staggers, calculus, "strupfen" (? mallenders).

Leaf xv. "Gerurt" (? gestossen = injuries from kicks), unthriftiness, weakness, "bug" (? buoge = atrophy of the shoulder).

Then follow some observations on the hair, grooming, a purgative, and some general "cures."

The following are representative of the recipes: (1) Lime and linseed oil as a liniment for foot galls; (2) Salt and dog's blood as a dressing for the umbilical

cord; (3) Lard, linseed oil and honey as a dressing for over-reach; (4) Powdered dog's bone as a dressing for wind-gall; (5) The skin and fat of a hare ground up with a crab and made into a plaster for punctured foot; (6) Sulphur and mercury ointment for wounds; (7) Proud flesh is bathed with nettle wine and then smeared with verdigris; (8) Scurf is removed by a dressing of urine, garlic and acid; (9) Chopped acorn and fresh urine as a drench for beetles in the stomach.

To his credit the author has avoided recommending incantations and has chosen his remedies with more discrimination than many writers of the following two



FIG. 1.

centuries. Some of his dressings, as judged by present-day standards, are not without value. On the other hand, he does not exhibit any knowledge of the prevention of disease by hygienic measures and dietary as taught by Columella, Vegetius and 'Chiron.' Also he does not appear to have appreciated the meaning of contagion and methods of isolation; for example, such well-known diseases as glanders and anthrax are not mentioned. Operative surgery is not referred to. As will be seen in the above summary the diseases are presented with little attempt

at systematic classification and none of their symptoms are described. True to its title the subject matter is merely a collection of "cures."

The statement on leaf xi—"ob ein ross geschossen wirt das man den pfeil nit gewinnen kan"—is found in the *Rossarzneibuch* of Andreas Albrecht¹ (published at

Dies büchlin sagt wie mā pferd arznyen vnd erkennen soll.

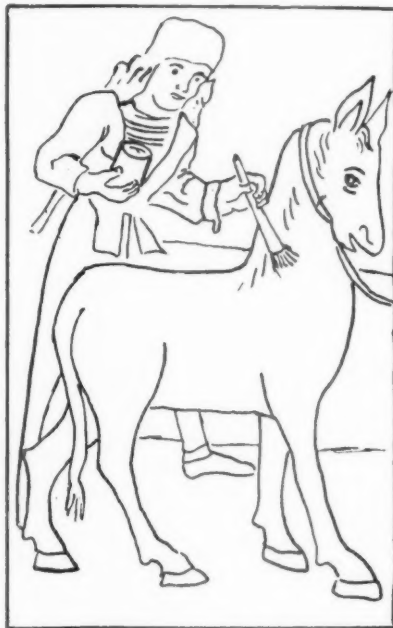


FIG. 2.

Ulm, 1498), who prescribes "if a horse is shot and one cannot get out the arrow" (see Smith, p. 101).

¹ Andreas Albrecht (circa 1355) is believed to have been veterinarian to Frederick II, and smith to the King of Naples.

Another piece of evidence as to its origin is the 4to entitled *Das Buchlin saget von bewerter Ertzeney der Pferd*, published anonymously at "Erfort" (Erfurt) in 1500. Moulé [3] (p. 14) states that its first page bears under the title an illustration of a man painting a lotion on a horse's chest. Though I have not seen this book I think it probable that the illustration had been copied from the woodcut entitled "Heilen einer Wunde" (fig. 3), which Froehner (1924) [4] has reproduced from a German reprint of Crescentius, published by Peter Drach in 1493. Petrus de Crescentius (see Smith, p. 89) was born in Bologna in 1240, and compiled an encyclopædia of agriculture for Charles II, King of Sicily, copying his treatments of animals from Jordanus Ruffus, Cato, Varo, Columella and the "Ippocras" of Moses of Palermo.



Heilen einer Wunde

FIG. 3.

Thus it would appear that both of these anonymous books of 1500 and 1502 were derived principally from Italian sources, though extracts were made from Albrecht, and possibly from the *De Animalibus* of Albertus Magnus (1206-80), and from the fourteenth century veterinarian Maurus of Cologne (see Moulé [2], p. 34).

There are two anonymous fourteenth century German books cited by Moulé [2] (p. 42), *De equis curandis notabilia germanica* and *Arsteyde* (? *Artzneyde*) *van den perden*, but we may conclude with Smith (p. 121) that writers in Germany in the fifteenth century, as in France, Spain and England, "were contented to copy Ruffus¹ or his mouthpiece Rusius."

¹ Jordanus Ruffus, chief veterinarian to Frederick II of Sicily (1212-1250) was "the regenerator of the veterinary art in Europe" (Smith, p. 75). A fifteenth-century German copy of his work is cited by Moulé, ii, (p. 29) as No. 226 in the Heidelberg Library.

(II) Een Schoon Medecijnboeckke

tracterende van dye natuerlijke crancheit alder dieren. Als van Peerden, Esels, Ossen, Koeyen, Verckens, Schapen, Duyuen, Hoenderen, Gansen, Eynden en Bien. Ghecopuleert wt Varone, Plinio, Virgilio, Paladio, den menschen seer profitelijc. Nu eerstwerck ghetranslateert wten Hoochduytsche ter nederlantscher spraken.

Een Schoon Medecijn
 boeck tracterende van dye natuerlijke
 crancheit alder dieren. Als van Peerden/
 Esels/Ossen/Koeyen/Verckens/Scha-
 pen/Duyuen/Hoenderen/Gansen/Eyn-
 den en Bien. Ghecopuleert wt Varone/
 Plinio/Virgilio/Paladio/den menschen
 seer profitelijc. Nu eerstwerck ghetransla-
 teert wten Hoochduytsche
 ter nederlantscher spraken



FIG. 4.

Author unknown, dated 1558, small 4to, printed in Gothic letter by the widow of Henrick Peetersen, of Antwerp. The title is printed in red and black above a half-page woodcut of a farmyard scene (fig. 4). In the background a farmer seated before his house, together with his wife, who is leaning over the lower half of the entrance door, look out upon their animals. These include a horse, several cattle,

sheep, swine, poultry and geese herded together by two farm-servants, a man and a woman. The farm-house is flanked on the right by a pigeon cote, on the left by three bee-hives.

Of the sixty unnumbered pages, fifty-five are devoted to the subject matter consisting of extracts from Varro, Pliny, Virgil and Palladius upon the diseases—and their treatment—of the horse, ass, ox, cow, swine, goat, pigeon, fowl, goose, game-birds and bees. Forty pages are occupied with advice on the management, working and treatment of disease of the horse, while ten pages are given to the management of bees. There are three pages of index.

It would appear highly probable that this Dutch book was translated from the anonymous German veterinary book cited by Moulé (p. 15).—" *Viehartznei Erziehung gebranch Lernung Artzney in Zufelligen und naturlichen krankheyten aller zahmen dem menschen gebrauchlichen und geheymen Thier und viehs. Als nemlich Pferd Essel, Ochsen, Kue, Sawe, Schaf, Tauben, Huner, Ganss, Wasser und lufftvoegel, Zunnen, Auss Varrone, Plinio, Vergilio, Palladio.*" According to Moulé this 4to, printed by Christian Egenolff (Frankfurt, 1550), contains two woodcuts. The woodcut of a farmyard is placed under the title, while the second, under the first chapter, shows two individuals examining a horse. Moulé also adds that the German book contains sixty-five recipes for the horse.

REFERENCES.

- [1] SMITH, F., *Early History of Veterinary Literature*, i, London, 1919. [2] MOULÉ, L., *Histoire de la Médecine Vétérinaire*, 2^{me} Période, Part II, Paris, 1900. [3] MOULÉ, L., *ibid.*, 3^{me} Période, Paris, 1911. [4] FROEHNER, R., in *Veterinarhistorische Mitteilungen* (Deutsch. Tierärztl. Wochenschr.), 1924, iv, No. 8.

ACKNOWLEDGMENT.

I am greatly indebted to Messrs. Maggs Bros., Conduit Street, London, who kindly permitted me to examine these two books and to photograph the woodcuts (figs. 1, 2 and 4), here reproduced.

Section of Dermatology.

[June 19, 1930.]

Demonstration on Carcinoma of the Skin Treated by Radium.

By STANFORD CADE, F.R.C.S.

IN radium treatment of rodent ulcer and epithelioma of the skin there arises the question whether one should apply a large dose of radium for a short time, or a small dose for a much longer time. By either method the skin lesion will heal in a certain percentage of cases. Hence it may be asked, "Why this change of technique to smaller doses and longer periods of time?" The answer is that though the immediate response is the same, there is a difference in the degree of permanence in favour of the new method. The newer method—a small dose long continued—is based on three main factors: the time factor, the intensity factor and the screenage factor. The first two are entirely dependent on the last. Though physicists tell us that 0.5 mm. of platinum is all that is needed for screenage, I have found it desirable to increase the screenage to 0.6, 0.7, or even 0.8, mm. of platinum. By this increase in screenage one can increase the time factor considerably, so that instead of a half-hour exposure it is possible to give from twenty to forty-eight hours, and instead of applying radium in one sitting it can be continued intermittently for as long as six weeks. Originally, we used a plaque of 8 mgm., or a tube of 10 mgm. for surface application; lately we have adopted the interstitial method, which has many advantages. It is the best method of treatment of a malignant lesion of the skin which has never had ray treatment before. It is indicated in all cases in which the skin lesion is not adherent to the bone. Cases which have already been treated by ultra-violet rays or by X-rays are not so suitable for this method.

Opposed to the interstitial method there is surface therapy. This consists in the application of radium containers, not on the skin but at 15 mm. from the skin, interposing between the skin and the radium a medium which diffuses the gamma rays uniformly, such as shellac or columbia paste. In this method, as opposed to the other, the economic factor comes in; by the interstitial method a case may be treated in seven days, but by the surface method it may take seven weeks.

With regard to lesions which have already received radium treatment—the most difficult lesions to treat—they are not always suitable for needling, and, moreover, after the second or third application, there is the possibility of producing a radium burn, especially in face lesions, without curing the patient. At Westminster Hospital we use a prosthetic appliance for the face, by which the radium can be kept in position for any number of hours. It is possible to regulate the dose in such a way that, if the extent of the lesion is, for instance 4 cm. by 2 cm., and the proposed dose 5,000 mgm.-hours, we can say—"It will take five or seven weeks to administer this dose". I think the longer the time factor, the better. In extensive lesions of the face, involving the maxillary antrum, or nasal fosse, a cast of the face

is taken and vulcanite plates are prepared to fit the lesion accurately, as shown in the plaster casts; the radium distributed in numerous small needles is placed on the cast and covered with shellac.

The shellac plates are lined with lead, and between these two layers are placed the needles. I have been told that lining these plaques with only 1 mm. of lead is ridiculous, as gamma rays are not stopped by this thickness of lead. We have, however, done some experimental work on this point which has proved that 1 mm. of lead is a great protection, and gives a much greater possibility of treating the patient the required time without a burn. In the treatment of lesions in the neck where the radium is distributed equally over the whole neck, a generalized erythema is produced. But, place over the sensitive thyroid cartilage a piece of lead—at the end of three weeks the skin will be purple, at the end of five weeks it will blister and peel, except in a small area—the area which is covered with lead. So, whatever physicists say, 1 mm. of lead *does* prevent vesication. And by this method a certain percentage of gamma rays, as well as beta rays, can be eliminated.

It may seem rash to treat epitheliomata of the skin caused by X-ray burns by means of radium, but I have treated these cases in this way, and it does not matter whether the epithelioma comes from a burn or from tar, or from some other cause—the object in view is to arrest the mitosis. It is, however, more difficult to treat an X-ray epithelioma, because in such cases there is some fibrosis round the blood-vessels and a disturbance of the tissue fluids of the stroma and of the reaction between the cells. Still there is a response, and these lesions can be made to disappear.

With reference to recurrences: epithelioma of the lip, or rodent ulcer of the eyelid can be made to disappear and to remain cured for ten years, perhaps for ever, by scientific radium treatment, but there are many lesions which do not disappear, and which, in spite of treatment, become worse, and the epithelioma can be seen growing in the area actually submitted to the effect of gamma rays. In such cases the margin between “selective radio-dermatitis” and a “burn” is a small one.

Therefore if the patient has been treated with radium once before, unless that treatment has been adequate and unless a period of a year has elapsed between the first and second treatments, we should never give more than half the initial dose; if we fail to obtain regression of the disease after that, the case is radio-resistant and the patient is unlikely to receive benefit from radium. In such cases diathermy is superior to irradiation. It is with that object in view that I have adopted the use of these boxes [shown]. Once we have treated the patient a second time with radium we can be said to have “burned our boats.” To obviate this necessity an attempt is made to prolong the treatment for five, six or seven weeks continuously. We protect the patient from beta rays by using 0.8 mm. of platinum screen; we protect the surrounding areas with lead or other metal, and we interrupt the treatment every 10 or 14 hours, but never allow the intervals to be of such length that the latent period is transgressed. By this method the treatment can be continued until there is a film over the whole of the affected area, even after the patient has been apparently radio-resistant.

As to radium, versus radon, treatment: in all my work I have used radium sulphate and needles. I am not enamoured of radon seeds, for several reasons, chiefly because to be successful it is necessary to apply radiation of uniform intensity throughout the whole extent of the lesion. This is very difficult to achieve with seeds except in small lesions.

If we use seeds we are liable to produce a burn at one place and to have inefficient radiation at another, and it is at the site of these that recurrences are apt to take place. I agree that a lesion no larger than a shilling can be treated satisfactorily by radon seeds, but even then there is a definite fall in intensity throughout the treatment. With radium itself, however, uniform intensity of irradiation is maintained throughout the whole period of treatment. Recurrences are particularly

apt to occur after the use of seeds in mouth lesions. Out of a large number of cases of carcinoma of mouth and tongue which I have treated, I have had more cases of local recurrence—i.e., at the spot where the lesion had been made to disappear before—after the use of seeds, than after the use of needles.

If we do not want the beta rays, we should try to screen them off altogether and not only 99·6%; by doing so 6% of the soft gamma rays are also eliminated, so that we are using hard, penetrating gamma rays only. These are applied slowly and at the correct distance, and in that way we have caused disappearance of the lesion for five years.

ILLUSTRATIVE CASES.

(I) *Epithelioma of Lip*.—Mr. A. B. Seven months' history of lesion on the right side of the lip, the size of a shilling. No palpable glands in the neck. On November 23, 1929, 10 needles each containing 0·6 mgm. of radium, screened by 0·5 mm. of platinum, were inserted deep to the lesion. Needles left in position for seven days. Total dose, 1,008 mgm.-hours. Neck not treated, as there was no evidence of enlarged glands.

The lesion has entirely healed, the lip appears normal, there is no induration on palpation, and there are no enlarged glands.

(II) *Epithelioma of Lip*.—Mr. G., aged 62. A case of two separate lesions, one near left angle of mouth, the other on right side of lower lip. First lesion appeared on left angle of mouth in August, 1929, and gradually increased in size. When first seen there was a nodular epithelioma, the size of a florin, upon the buccal mucosa. No palpable glands. Radium needling on November 9, 1929. Seven needles of 0·6 mgm. each, screened by half a millimetre of platinum inserted around the lesion. Total dose in seven days, 732 mgm.-hours. On March 8, 1930, a second lesion developed on the right side of the lower lip. It was the size of a sixpenny piece when first seen and had ulcerated on the surface. Four needles of 0·6 mgm. each were inserted deep to the lesion and left in position for seven days. Total dose 383·2 mgm.-hours. The lesion healed rapidly.

(III) *Rodent Ulcer*.—Mr. A. V., aged 37. Two years' history of wart on back of left wrist, rapidly increasing in size. Also had pulmonary tuberculosis and has been five months in a sanatorium. First seen August 31, 1929, with a lesion on back of left wrist. A biopsy showed this to be a typical rodent ulcer. Treated by means of surface application only. Twelve needles each containing 0·5 mgm. of radium, screened by 0·5 mm. of platinum, applied continuously day and night for three days at a distance of 15 mm.; then in contact for twelve days, 10 hours daily. Total dose, 920 mgm.-hours. The lesion has not entirely healed; in the centre there is still a small area about 2 mm. square, covered with a scab.

(IV) *Epithelioma of Cheek*.—Mr. T. C. A. Aged 50. Epithelioma of inner side of cheek in angle of mouth. First seen January 17, 1928. Eight needles inserted, each containing 0·6 mgm. of radium, screened by 0·5 mm. of platinum. At the end of three days an additional surface application by means of wax was begun (see fig. 1, p. 56). Total dose, 1,200 mgm.-hours. Has now been well for two and a half years.

(V) *Epithelioma of Lip and Face*.—Mr. H. B. Aged 74. Fifteen months' history of ulceration on left side of cheek involving angle of mouth, lip, and buccal mucosa. Has been a clay-pipe smoker for forty years. On examination: Extensive neoplasm of the lip, involving skin of face for at least two inches.

March 2, 1930.—8·7 mgm. of radium inserted interstitially in the form of eleven needles. Left in position for seven days. Total dose, 1,463 mgm.-hours.

March 8, 1930.—Needles removed and re-inserted for a further week with the addition of three needles. The total dose given interstitially was 3,479 mgm.-hours in fourteen days.

April 26, 1930.—A plaque was made fitting the angle of the mouth and carrying twelve needles at 0·6 mgm. of radium each. This was worn eight hours a day for twenty-two days. Total dose, 1,267 mgm.-hours. The ulceration has entirely healed. The skin still shows an area of induration containing numerous small masses of sebaceous material.

(VI) *Epithelioma of Lip*.—Mr. I. H. Epithelioma of lower lip on left side, the size of a sixpence. Duration, two months. No palpable glands in the neck. Treated on March 12, 1929. Six needles at 0·6 mgm., screened by 0·5 mm. of platinum, inserted around and deep to the lesion. Left in position for seven days. There was a severe reaction with the formation of a film on the upper lip, opposite to lesion. Total dose, 604·8 mgm.-hours. The lesion has healed. There is only slight scarring. The lip feels soft and supple. There are no palpable cervical glands.

(VII) *Rodent Ulcer*.—Mr. J. B. Aged 64. Rodent ulcer, on lower eyelid and at inner canthus of right eye, size, 1 in. by $1\frac{1}{2}$ in. (fig. 4 p. 58). Twenty years' history. Treated November 30, 1929; ten needles at 0.6 mgm. of radium, screened by 0.5 mm. of platinum, left in position for seven days. Total dose, 1,008 mgm.-hours. Lesion entirely healed (fig. 5, p. 58). Slight eversion of lower eyelid.

(VIII) *Rodent Ulcer of Face*.—Mrs. A. B. Aged 58. History of two rodent ulcers on the right side of the face for many years. Treated at two hospitals by excision, cautery, scraping, X-rays, etc. First seen at Westminster Hospital on June 13, 1929. Treated with 8 mgm. of radium on a plaque screened by 0.1 mm. of gold only. Four weekly sittings of two hours each. Total dose, 64 mgm.-hours. Severe reaction and heaping up of epithelium. One lesion completely healed and the other presented a small scab, and on May 7, 1930, the upper lesion was treated for two hours with the same 8 mgm. plaque. At present shows a typical reaction of this method of treatment (that is of beta and gamma ray therapy). Since then the scab has separated and both lesions are now entirely healed.

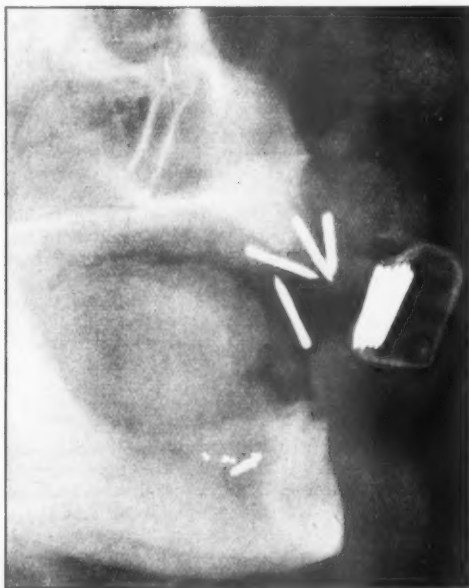


FIG. 1.—Skiagram showing four radium needles inserted interstitially and a surface applicator of columbia paste carrying six needles of 0.6 mgm. each.

(IX) *Epithelioma of Nose and Lip*.—Mrs. E. W. Aged 54. Eight years' history of ulceration of nose and upper lip. Began as a small nodule, which at first was a rodent ulcer, but after a few years became a squamous-celled epithelioma. The ulcer was very extensive and had eaten away most of the nostrils, exposing the septum and the vestibule of the nose. The columella had entirely disappeared and the upper lip in the centre was deeply ulcerated (see fig. 6, p. 59). On July 6, 1929, the following radium treatment was given: A total of 20.7 mgm. of radium, distributed in nineteen needles, screened by 0.65 mm. of platinum, was inserted around the lesion. The needles were left in position for seven days. Total dose, 3,366.2 mgm.-hours. The response to treatment was rapid. The exuberant mass shrank, and the resulting raw surface was covered with a white fibrinous membrane. The lesion healed entirely with slight deformity (fig. 7, p. 59).

(X) *Rodent Ulcer*.—Mrs. A. F. Aged 88 years. Eight years' history of ulcer near outer canthus of right eye. Eighteen months ago a small pimple appeared on the right cheek



FIG. 2.—Case V. Condition before treatment.

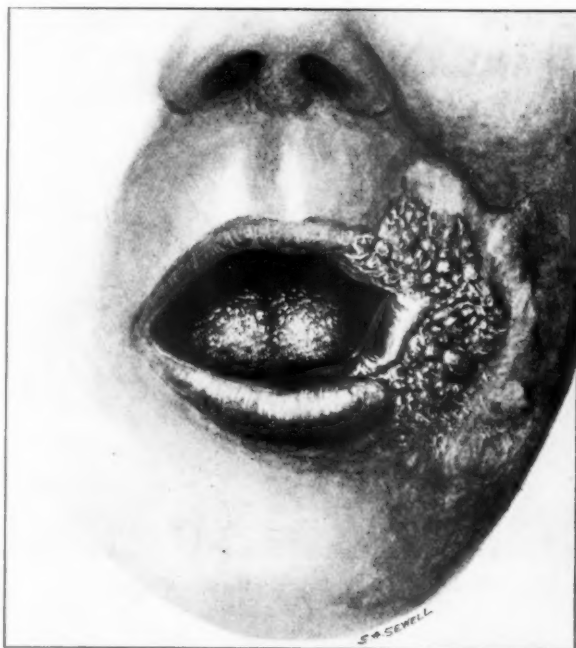


FIG. 3.—Case V. Condition four months later.

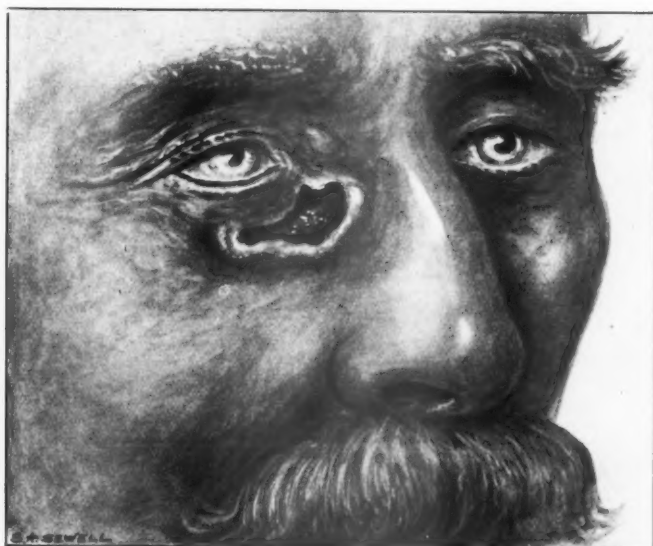


FIG. 4.—*Case VII.* Before treatment.

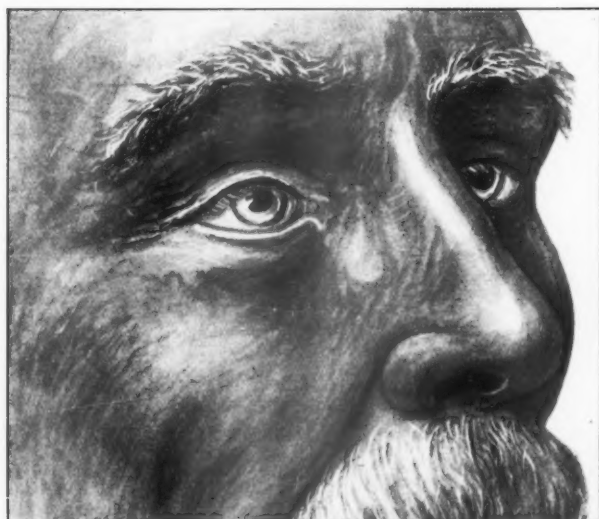


FIG. 5.—*Case VII.* Four months after treatment.

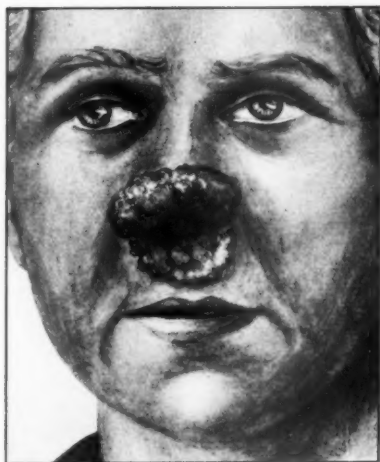


FIG. 6.—*Case IX.* Before treatment.

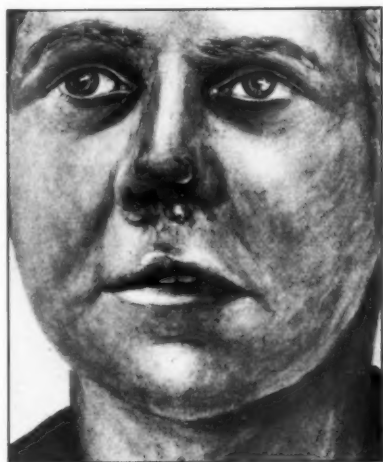


FIG. 7.—*Case IX.* Five months after treatment.

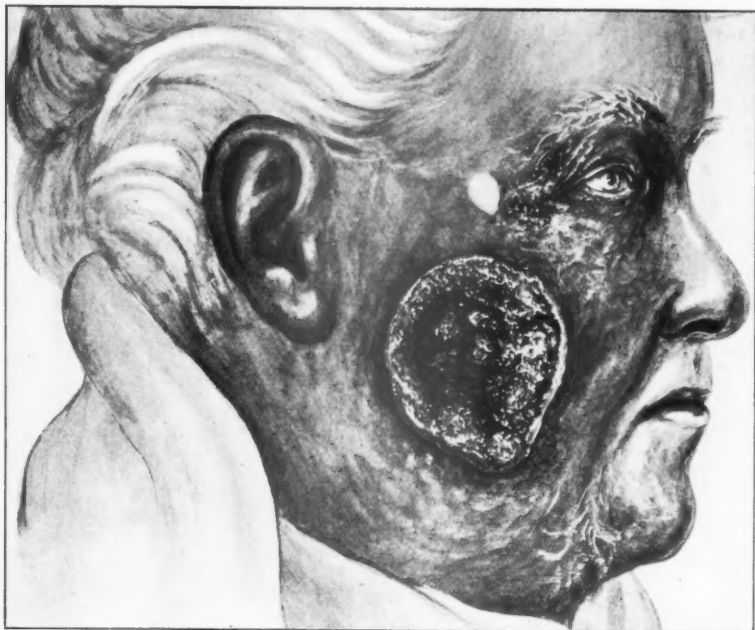


FIG. 8.—*Case X.* Before treatment.



FIG. 9.—*Case X.* Three months after treatment. The main lesion has healed and is epithelialized except the centre. There is a fresh lesion in front of the ear.



FIG. 10.—Case XI. Before treatment.



FIG. 11.—Case XI. Six months after treatment.

which spread and ulcerated until a large ulcer formed destroying the right cheek, but not actually perforating into the mouth. When first seen there was a large ulcer three inches in diameter on the right cheek, with large secondary sepsis; there was also a small ulcer over the malar bone, which appeared to be of slower growth (fig. 8, p. 60). There was a mass of glands in the right submaxillary area. Histological report: "Squamous-celled carcinoma."

February 15, 1930, under general anaesthesia, the ulcer was surrounded by 16.4 mgm. of radium in sixteen needles, screened with 0.6 mm. of platinum. The needles were removed ten days later. Total dose, 3,946 mgm.-hours by interstitial irradiation. March 15, 1930. Small columbia paste plaque made to irradiate glands of neck. Plaque contained 25 mgm. and was applied for fourteen hours daily up to April 6. Total dosage to glands 6,074 mgm.-hours by surface application. May 17, 1930, ulcer healing rapidly. A small ulcer has appeared in front of the right ear.

May 24, 1930.—The fresh lesion was needled under local anaesthesia. Six needles of 1 mgm. inserted and left in position seven days. Total dose, 1,008 mgm.-hours by interstitial irradiation. This ulcer is now healing (fig. 9, p. 60).

(XI) *Epithelioma of Nose, Eyelids and Face*.—Mr. A. B., aged 39. Lupus vulgaris of the face of fourteen years' duration. Two years ago epitheliomatous change with destruction of nose and part of eyelids on left side (fig. 10, p. 61).

On Examination.—A dwarf, with old healed tuberculosis of spine. Sputum negative for tuberculosis.

November 30, 1929.—General anaesthetic. Thirty radium needles, each containing 0.6 mgm. of radium, screened by 0.5 mm. of platinum, inserted into edge and base of ulcerated area. 10 mgm. for seven days. Total dose, 3,024 mgm. hours.

December 7, 1929.—Operation repeated under general anaesthetic. Twenty-four needles, each containing 0.6 mgm. of radium, inserted. 14.4 mgm. of radium for seven days.

December 14, 1929.—Edges of wound look much healthier, especially nasal part. Total of two irradiations, 5,439 mgm.-hours by interstitial irradiation.

January 5, 1930.—Surface irradiation by means of a columbia paste plaque made to fit into facial excavation. Plaque contained twenty-one needles at 0.6 mgm. each; 12.6 mgm. of radium applied intermittently for 10 or 12 hours daily.

January 16, 1930.—Treatment stopped. Total dose of surface irradiation 1,963 mgm.-hours.

February, 1930.—Left eye totally destroyed by secondary sepsis, but response to radium satisfactory.

March, 1930.—Disease appears to be checked. Edges of ulcer are healthy and growth on the base of ulcer has become flattened out. Enlargement of pre-auricular gland on left side to be treated in the near future. The end-result is seen in fig. 11 (p. 61).

There is no evidence of any active epitheliomatous change. The edge of the skin is healthy. The antrum and nasal cavities are exposed, but are covered with healthy mucous membrane. The edges of the anterior wall of the maxillary antrum are necrosed, but not yet ready for sequestrectomy. The general health of the patient is improved. There is no pain.

On the Use of Radon in the Treatment of Neoplasms of the Skin.

By R. T. BRAIN, M.D.

I WILL first discuss the question of dosage, as Mr. Stanford Cade objects to radon because its period of useful activity is practically limited to eight days. He rightly points out that, if a lesion requires further irradiation at the end of that time, one would have to insert fresh radon containers, and this would result in a very uneven exposure to gamma radiation, not to be compared with the unvarying effect obtained with radium element. I do not think that this objection holds in the treatment of small superficial epitheliomata of varying types seen by dermatologists, because effective dosage may be administered by a single application of radon.

The problem of individual dosage is a difficult one but there is accumulated experience which indicates the lines along which experimental therapy could most

profitably be directed. Up to 1927 Dr. J. H. Sequeira had treated over 1,500 cases of rodent ulcer with radium. (See Sequeira, "Diseases of the Skin," 1927, p. 563.) The great majority of these cases were completely cured and have remained under observation cured; the hospital records date back to 1902. (See *Brit. Med. Journ.*, 1915 (i), 365.) The routine treatment, evolved by trial and error, was three applications of an unscreened varnished plate, in close skin contact, for two hours, at intervals of six weeks. Ultimately, three radium plates were in constant use in the London Hospital Skin Clinic; one being "full strength" and having approximately 5 mgm. of radium element spread over each square centimetre of surface, the other two plates being half that strength. It is a curious but certain fact that the clinical effects produced by these plates of different strength were so uniform that eventually the various plates were used indiscriminately without specification.

A rodent ulcer not exceeding 1 cm. in diameter, treated by one of these applicators, would receive three doses, each equivalent to 5 or 10 mgm.-hours, at six-weeks intervals, the total effective irradiation certainly being less than 30 mgm.-hours given as a single dose, and in some cases less than half this dose. When we apply to such a lesion a single radon seed containing one millicurie of emanation, at the end of eight days there has been a yield of rather more than 100 millicurie hours of radiation, equivalent to 100 mgm.-hours as obtained from radium. This dose represents the sum of 192 hours of diminishing radiation and is three to six times that given as the routine treatment in Dr. Sequeira's series of cases. It is admitted that the comparison is not a very accurate one, for, when using a seed, the radiation comes from a small source, and there is no appreciable "cross-fire," as would be obtained from a flat applicator, or by the use of several seeds. It is possible considerably to exceed this hypothetical dose by using seeds with a greater radon content, or by using several seeds near together. It would seem that the larger doses obtained by such means are rarely needed in dermatology.

Radon is infinitely cheaper than radium, and from certain centres radon seeds may be obtained for a few shillings each. The London Hospital disposes of its surplus seeds at two shillings each, the actual cost price.

There is a peculiar property of radon which makes some difficulty in the estimation of dosage. Chart I (p. 64) shows this peculiarity as a curve; how radon is a substance of "short life," so that after 3.85 days only one half of the initial amount remains. In spite of this, it is not difficult to calculate the equivalent radiation from a radon tube, and Chart II (p. 64) shows diagrammatically the doses which would be obtained from 1 mgm. of radium element and from 1 mc. of radon for periods up to ten days. The doses from radium increase uniformly with the time period, whilst with radon there is an apparent lag, so that the ten-days' dose is but little greater than the eight-days' dose. It is useful to remember that, if one takes the figure for the initial value of a radon seed in millicuries and multiplies it by 100, the resulting figure is approximately equal to the dosage in millicurie-hours obtained from that seed if applied for eight days.

Let us consider briefly the results of treatment with radon. In Dr. O'Donovan's Clinic at the London Hospital during the past nine months, forty-nine cases have been treated with radon, whilst in the same period, 153 cases have been treated with radium plates. On the whole the results are satisfactory, but there has been much more necrosis of tissue in the cases treated with radon than in cases treated concurrently by radium plates. This is probably because the seeds were buried in the tissues and the irradiation is intense just around the seeds. Also, as stated previously, the total dose administered considerably exceeds that given by a radium plate applied for two hours. The illustrations show how rapid and effective treatment with radon can be. In five or six weeks the lesions have disappeared, and the visible reaction of the tissues to the irradiation has either completely subsided or there remains a zone of erythema around a slightly depressed scar.

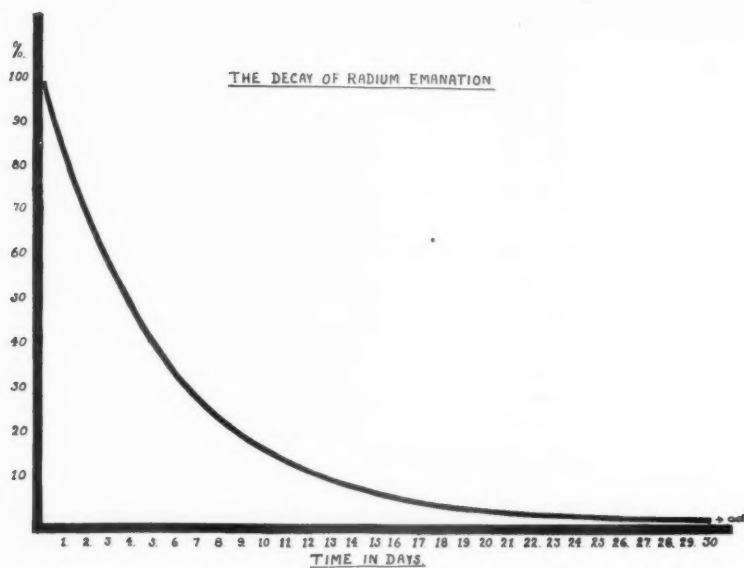


CHART I.

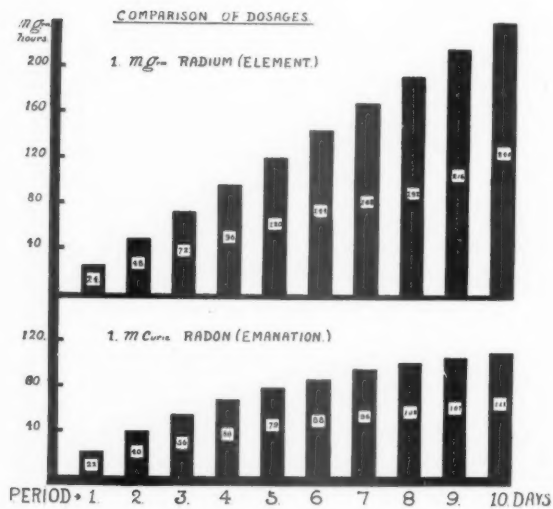


CHART II.

ILLUSTRATIVE CASES.

(I) Patient, man aged 61. Three weeks' history of a nodule rapidly growing on a pigment mole on right cheek (fig. 1, p. 66).

Diagnosis.—Squamous-celled epithelioma, confirmed by histological examination.

January 31, 1930.—Three radon seeds inserted; contents 2.1 mc. each. Seeds removed after five days. Total irradiation to whole lesion 480 mc. hours.

March 12.—Lesion gone. Skin healed (fig. 2).

May 14.—Still sound.

(II) A man aged 55. Diagnosis: Tar carcinoma below left eye (fig. 3, p. 66).

March 26.—One seed containing 2.3 mc. inserted in diameter of lesion. Seed removed two days later. Total irradiation 100 mc. hours.

April 27.—Lesion gone. Skin healed (fig. 4).

(III) A man aged 65. Diagnosis: Rodent ulcer lower eyelid of one year's duration (fig. 5, p. 67).

December 2, 1929.—One seed containing 2 mc. inserted parallel to lid margin and left for nine days. Total irradiation, 212 mc. hours.

January 15, 1930.—Lesion gone. Skin healed (fig. 6).

April 30, 1930.—No recurrence.

(IV) A man aged 46. Diagnosis: Rodent ulcer at inner canthus. Eight years' duration (fig. 7, p. 67).

December 9, 1929.—Two seeds each containing 2.6 mc. inserted parallel to edge of lower lid reaching inner canthus. Seeds removed after four days. Total irradiation 354 mc. hours.

January 13, 1930.—Lesion gone. Skin healed (fig. 8).

March 3, 1930.—No recurrence.

Perhaps these cases are sufficient to illustrate how much can be done with radon seeds measuring 1 cm. in length and costing but a few shillings. If the proper dose is given it will rarely be necessary to administer a second treatment.

Discussion.—The PRESIDENT said that small rodent ulcers had been treated with radium by dermatologists for a great many years, with a reasonable amount of success. It was in the large ulcers invading the periosteum and mucous membrane that radium plaques had failed, and the newer methods, such as those demonstrated by Mr. Cade, had to be adopted.

Dr. J. H. T. DAVIES asked what screenage Dr. Brain used when applying radon seeds.

Dr. A. C. ROXBURGH said that he would like to know whether Dr. Brain's custom was to leave the seeds *in situ*, or to remove them, or whether they sloughed out.

Dr. J. E. M. WIGLEY said that he had seen a case in which the condition clinically was a rodent ulcer on the chin. The patient had been treated, he thought, both by the external application of radium, i.e., by putting a plaque on and by the insertion of radium needles. She had a very violent reaction from each dose, though there was an interval of six months between the applications. When he saw her there was a scar in the centre of the lesion, with rodent tissue around. In such a case would Mr. Cade persist with radium, or prefer to carry out ordinary surgical excision?

Mr. STANFORD CADE (in reply) said that as Dr. Wigley's patient had had two violent reactions after two radium treatments and the disease was still active, it must be acknowledged that radium had failed, and treatment should be by excision, preferably by the diathermy knife.

Dr. Brain had emphasized the cheapness of the radon seeds (2s. per seed), but in reality seeds were the most expensive way of applying radium, for one must remember that there would need to be: A £500 plant for producing the seeds, at least £800 a year salary for the physicist, £150 for the assistant, who could only work nine or ten months in the year, and about 500 mgm. of radium at a cost of £6,000. The supposed cheapness of the seeds was not altogether what it seemed.

Dr. R. T. BRAIN (in reply) said that there was at the present time a considerable quantity of radium under lock and key which was entirely reserved for the production of radon and it

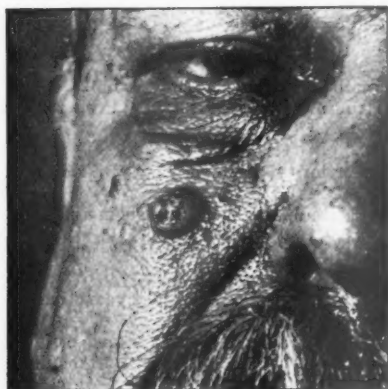


FIG. 1.—Case I. January 31, 1930.



FIG. 2.—Case I. March 12, 1930.



FIG. 3.—Case II. March 26, 1930.



FIG. 4.—Case II. April 27, 1930.



FIG. 5.—Case III. December 2, 1929.



FIG. 6.—Case III. January 15, 1930.



FIG. 7.—Case IV. December 9, 1929.



FIG. 8.—Case IV. January 13, 1930.

produced the emanation whether the latter was being utilized or not. The London Hospital possessed a gramme of radium for this purpose and some other hospitals had a like amount. As about 150 millicuries of emanation could be separated daily from one gramme of radium, it followed that over 100 seeds could be prepared and economically distributed for curative purposes in and around London from this single production unit.

For screening the seeds, 0.3 mm. of platinum was used, this being the thickness of the walls of the metal container. No additional screens were employed.

Physicists stated that 0.6 mm. of this metal screened off 99.9% of the beta rays. Mr. Stanford Cade had found that thicker screens were desirable. It was possible that the area of purulent necrosis, which was so often seen around a seed, was due to the beta rays, and that there would be a more favourable reaction if the screening was more efficient.

His (the speaker's) present technique of insertion was to run the seed along the track of a tenotomy knife or of a large bore intramuscular needle, the small puncture of entry being sealed with collodion. He began by following the practice of the surgeons and leaving the seed in the tissues for eight days; it was said that this exposure would destroy the malignant cells in one cubic centimetre of tissue. He had wondered whether the slowness of healing in some cases was not due to excessive irradiation rather than to the unchecked activity of the malignant process. Therefore in Dr. O'Donovan's clinic the dose was being gradually reduced and the seeds were left in the tissues for varying periods of from one to eight days. At the end of this time the collodion seal was removed and on squeezing the lesion; the seeds usually popped out, lubricated by a sero-purulent discharge.

(The concluding report of this meeting will be published in the next issue of the *Proceedings*.)

Section of Electro-Therapeutics.

[March 21, 1930.]

Diaphragmatic Hernia.

By J. M. WOODBURN MORISON, M.D.

TWO great French surgeons, Ambroise Paré and Jean Louis Petit, must ever be associated with the subject of diaphragmatic hernia.

Ambroise Paré (1510-1590) was born at Bourg-Hersent, a little village which now forms part of the city of Laval, in the old province of Maine. The exact year of his birth is somewhat doubtful. Malgaigne says 1517, but Le Paulmier gives it as 1510, and Pierre de l'Estoile in his *Mémoires Journaux* wrote as follows:—

"Thursday, twentieth of December, 1590, the eve of St. Thomas, died at Paris in his own house, Master Ambroise Paré, surgeon to the King, aged 80 years, a learned man and the chief of his art."

He lived in troublous times, the time of Catherine de' Medici and Henry II, when Europe was in a state of almost constant war. He took part in several campaigns and was the first surgeon to ligature blood-vessels on the field of battle. The earliest records of diaphragmatic hernia are found in the works of Ambroise Paré. The first edition of his collected works was published in 1575, but the following abstract I have taken from the Malgaigne edition of 1840, in which Malgaigne writes:—

"Je ne sache pas que personne avant Paré ait fait mention des hernies diaphragmatiques, dont il rapporte deux observations."

Case I.—The first case was that of a mason, who was wounded in the middle of the diaphragm. He died on the third day after the injury. Paré made the post-mortem examination. He relates that on opening the abdomen he could not find the stomach, at which he marvelled greatly: "Pensant que ce fust une chose monstrueuse d'estre sans estomach." He found the stomach in the thorax. It had passed through a small opening in the diaphragm, no larger than would admit a thumb.

The second case is more fully described.

Case II.—Capitaine François d'Alon, belonging to the suite of Monsieur de Biron, Grand Maître de l'Artillerie de France, received at La Rochelle a wound from an arquebus. It entered at the end of the sternum, traversed the diaphragm, in its fleshy part, and came out between the fifth and sixth ribs on the left side. The wound healed, but afterwards he suffered from colic and was only able to take light food. Eight months later he suffered from great pain and died, in spite of all remedies that were administered. A post-mortem examination was made by Jacques Guillemeau, surgeon to the King. A great part of the colon was found in the thorax, having passed through a small hole in the diaphragm, made by the wound, although the opening was only large enough to admit the little finger.

These were the first cases of diaphragmatic hernia to be recorded.

Jean Louis Petit, one of the most brilliant surgeons of the eighteenth century, born March 13, 1674, died April 20, 1750, was the first to clearly differentiate the condition known as eventrated diaphragmatica from the usual diaphragmatic hernia.

In his writings he states that he has seen two cases of diaphragmatic hernia, and that other cases had been seen by several of his colleagues. He recognized that congenital defects occurred in the diaphragm, and noted the absence of a hernial sac in the first case he recorded. He also commented on the fact that both the herniæ of the diaphragm which he had seen were on the left side. His confrères told him that all those which they had seen were likewise on the left side. This led him to suggest that the convex surface of the liver protects the right side of the diaphragm. The two cases which he described were in adult males, and clinically of long standing.

The first case was a diaphragmatic hernia, in which, at post-mortem, a great part of the stomach, a portion of the colon, and part of the omentum was found to have passed through a defect in the dorsal part of the left diaphragm, into the thorax. There was no hernial sac and there were no adhesions.

In the second case also, the hernia was on the left side, and Petit states that he considered it to be a congenital abnormality. At the post-mortem examination, on opening the chest, he found a tumour the size of "a small gourd," formed by a portion of the stomach, colon and omentum, and enclosed in a hernial sac which was formed by peritoneum, diaphragm and pleura. A "thick lymph" of recent origin had caused adhesions to the lower lobe of the lung, and the contents were similarly held together, so that when removed from the sac they kept the shape of the whole tumour. The death of this patient was attributed to "inflammation of the abdomen." It is thus seen that Petit clearly recognized that his second case was of a different type from the usual diaphragmatic hernia.

To deal adequately with the literature of this subject would require far more time than I have at my disposal to-night. I must content myself with stating that a few cases were described in the seventeenth century, Hildanus recording a case due to a stab wound in 1646, and Riverius a congenital case in 1698. The case mentioned by Riverius was that of a young man, aged 24, for whom an overdose of some preparation of antimony had been prescribed by a quack for a cure of intermittent fever. He died in consequence, and the stomach was found in the right side of the thorax.

In the eighteenth century a good many cases were described and some of them are of great interest.

In 1701 Hold records a case of a child who lived for two months; at the post-mortem examination a foramen was found in the diaphragm at the left side of the opening which gives passage to the œsophagus, through which a portion of the duodenum had passed, dragging the pylorus towards the fundus of the stomach, while the mesentery and connected intestines were seen spread over the heart and lungs in the thoracic cavity.

In 1706 Becker, at a post-mortem examination, found a double hernia of the diaphragm in a child five years old. The heart and liver were in the right chest and the spleen and stomach in the left.

In 1717 Martin St. André writes about a gentleman who had taken some new bottled ale and some pints of wine. He was the same night seized with violent colic. He was given an emetic and vomited eight or nine times. When St. André saw him he had violent pain over the whole abdomen, a frequent inclination to vomit, a great difficulty in breathing and a very slow pulse; "the whole belly, though not swelled, was as hard as a stone," and from this symptom St. André predicted that phrenic hernia would be found. Post-mortem: The opening which transmits the sympathetic nerve was dilated and had allowed the greater part of the omentum and pancreas, as well as a portion of the colon, to pass. These had become strangulated. This case is identical with the one quoted by Morgagni as Platner's case, the probability being that Platner was quoting St. André's case.

Chauvet, in 1729, relates the case of a lieutenant-colonel in which the stomach, spleen and colon were found in the left thoracic cavity, passing through an opening with a cartilaginous margin to the left of the spine.

Kirschbaum, in 1755, reported seventeen cases.

Morgagni, in 1769, wrote a monograph on diaphragmatic hernia. He gives a description of hernia through the natural apertures of the diaphragm.

One case was that recorded by St. André and the other was that of a person who had a violent cardialgia which came on in the morning at break of day and was attended with frequent vomiting of an incredible quantity of blackish matter, and with straining to vomit, so that the young man died on the following night. Within the thorax was found omentum, intestine, duodenum, jejunum, and part of the ileum, which had passed through the œsophageal opening, this foramen being greatly dilated.

He quotes Leprotti's case—that of a husbandman at Rome—in which part of the colon passed through the anterior part of the diaphragm, behind the xiphoid cartilage, through an aperture of two thumbs' breadth.

Morgagni also mentions two cases in which natural openings in the diaphragm were greatly enlarged without any hernial protrusion, these being the opening for the vena cava and the opening for the œsophagus.

M. de Vicq d'Azyr in 1772 described the case of a child who, shortly after birth, died in strong convulsions. Post-mortem the liver was found forming a hernial protrusion through the right fibres of the diaphragm. The hernial sac, which contained a considerable portion of the liver, was tighter at its entrance than at its base, so that this viscus was, as it were, strangled.

Petit's two cases, recorded in 1774 by his pupil Lesne, have already been referred to.

John Ferriar in his "Medical Histories and Recollections" in 1792 records a post-mortem case.

He says, "on opening the body, I was surprised to see no omentum, for the subject was very fat; on diligent search, it was found that the omentum was pushed up into a sac formed by the diaphragm and actually lay within the thorax on the right side; as this sac, which was large enough to contain the hand, had a very small neck, the omentum was not brought down again without force."

Dr. Bowles, of Bristol, in 1796, sent an account of a post-mortem examination which he had performed, to Sir Astley Cooper who quotes it in his treatise on hernia:—

"A man, aged 50 years, had died from an excessive vomiting after an emetic. A sac larger than a tennis ball was found in the right thorax, which contained the right extremity of the stomach, and beginning of the duodenum, a part of the omentum and the arch of the colon. The sac was formed of pleura and peritoneum, and the orifice was placed at a small distance from the right side of the ensiform cartilage where there appeared a deficiency of fibres in the larger muscles of the diaphragm, corresponding to the size of the sac. The right lung was smaller than usual."

There was nothing of importance in this man's history, but he had suffered from asthma.

In the nineteenth century there are many hundreds of cases recorded, mostly individual cases, but the outstanding writers are:—

Sir Astley Cooper, 1824, who extracts two cases of his own from "Medical Records and Researches," 1798, and quotes many others. He had never seen a hernia through any of the natural openings of the diaphragm but was familiar with congenital defects in the diaphragm and with wounds or lacerations of the diaphragm as the cause of hernia.

Cruveilhier in 1829 and in 1849 writes at length on this subject. He refers to Petit's cases and it is to Cruveilhier that we are indebted for the term "eventration"

—he uses it as synonymous with hernia. He discusses congenital malformations of the diaphragm, and herniæ or eventrations due to direct injury of the diaphragm by a sword thrust, bullet, or fractured rib, and he notes that wounds of the diaphragm never heal, and that, later on, it is almost impossible to distinguish such a condition from a congenital one. The tomes contain many beautiful illustrations.

Bowditch in 1853 collected eighty-eight cases from the literature.

Balfour, in 1869, reported one case of his own and collected fifty-seven cases from the literature.

In 1880 an excellent paper was written by Lacher. In his tables of 276 cases of diaphragmatic hernia he gives:—

			Right side		Left side	
Congenital	...	117	...	19	...	98
Injury	...	150	...	23	...	127

I have not, so far, mentioned the writings of the military surgeons, but in these many cases of injury to the diaphragm are recorded. Guthrie's "Commentaries on the Surgery of the War in Portugal, Spain, France and the Netherlands," is far more interesting than the modern novel; he tells a graphic story of adventure. In his preface he writes:—

"On the termination of the War in 1814 I expressed in print my regret that we had not had another Battle in the South of France to enable me to decide two or three points in Surgery which were doubtful. I was called an enthusiast and laughed at accordingly. . . The Battle of Waterloo afforded the desired opportunity."

In speaking of injuries of the chest he expressed his sorrow that

"so many of the students who presented themselves for examination in order to obtain the authority of the Royal College of Surgeons of England, to call themselves Surgeons, were profoundly ignorant of the first principles of the treatment of these injuries, and it is with reference to these injuries especially, that the surgeons of the French Army have done good service."

In his introductory lecture he records how

"The French Army advanced from and around Ciudad Rodrigo, in September, 1811, to enquire after the British, which was dispersed by divisions in cantonments in the neighbourhood of that place. Marshal Marmont inspected his army in the plain, in front of Elboden, and a goodly show his soldiers made; the day was remarkably fine, and the marshal being on a white horse and surrounded by a brilliant staff, was prominently conspicuous. On the 25th, the fight of Elboden took place. The third division of infantry, with a small body of German and English Cavalry and artillery, had it all to themselves, but were forced to retreat before very superior numbers. The next day, the fourth division of infantry, to which I then belonged, took their turn on the heights of Saca Parte, in the rear of Aldea del Ponte. The fight was sharply contested, but the English maintained their ground, the French being repulsed. I had now 300 wounded, of all arms, from the two days, without knowing what was to be done with them, as a further retreat was ordered. At midnight I saw the last wounded man out of the village, and at daylight, when near Alfaiates, I found the head of the medical department of the army sitting on a pannier by the roadside, and apparently keeping guard over some twenty or thirty others arranged in a semi-circle around him. He was one of the best men in the world, but having slept out all night, looked as unhappy as need be for a man not used to it, and not a little frightened withal. It was impossible to avoid laughing, when he quietly said 'I am here taking care of the medical stores of the army, whilst the apothecary is watering the mules, lest the muleteers should run away with them.' 'I have seen,' he added, 'a great many wounded passing. Are they yours?' I bowed, and asked if he had told them where to go. No, he had not interfered, for he did not know where to go himself, he did not know the country. I assured him the French would be up in about half an hour, and that he had better make up his mind on that point; he would, however, see their brass helmets at least a mile off, and that he had then better be off as fast as possible. The apothecary now returned with the mules, and such a packing took place, but where to go was the question. I ventured to recommend Sabugal, as it would be in the rear of the position

the army was to take up, and from which I did not think, as the troops were all assembled, it would be readily dislodged, but that I should, with his permission, stop at Alfaïates with my wounded. I ventured even to add that the contents of some of the panniers would be very acceptable; might I take some few things out as the cortège went through Alfaïates. Oh yes, I might do as I liked, and take anything I pleased. 'And you will not disown' I added, 'anything I do?' 'Oh no, provided you do not disobey orders.' This was not quite so satisfactory, as I knew I could do little else, it being contrary to all orders being there at all. I stayed at Alfaïates three weeks, until a friend died, about whom I was greatly interested, and had hoped to save. The case is No. 141 of my book on 'Injuries of the Chest'. He was shot through the left lung, the diaphragm and the liver, the ball going through from side to side. The examination, after death, proved a fact I had before suspected, viz., that a wound in the diaphragm never heals, but remains a hole, even if the person should live for years. It was a fact rewarding the three weeks' very hard work I had brought upon myself and is now undisputed. My excellent friend of the panniers, the head of the department, since dead, but of whom I even now think of with great personal regard and esteem, was superseded shortly afterwards, by a gentleman, some fifteen per cent., in mercantile language, more inefficient than himself; and it was not surprising that, between them, 22,000 men of that army, as historians say was the case, or any other possible number, should have been in hospital."

The author records the following case:—

"A soldier of the 12th Dragoons (Case 147, *op. cit.*) was wounded, at Waterloo, by a sword, which penetrated the left side of the chest diagonally, and came through the opposite or right side below, having in its way, as was supposed at the time, injured the diaphragm. The man recovered and returned to his duty. On the 6th of September, nearly fifteen months afterwards, he was attacked, after cleaning his horse, by all the symptoms of a strangulated internal rupture and died next day. On opening the body, the greater part of the stomach was found to have passed through a hole in the diaphragm, made by the sword, and had become strangulated, like any other part constituting a hernia or rupture."

He goes on to state that he had told these stories in order to draw an inference and to conclude with a precept.

"When a man has recovered from a wound which has been supposed to have left a hole in his diaphragm, he must not clean a horse, nor tie his own shoes, nor even bend his back, beyond making a bow—I do not forbid that, if he cannot help it. He must eat sparingly at a time, drink less, and sleep as much as possible, in a somewhat raised position. When, however, all possible precautions have been taken in vain, and he is distinctly suffering from the symptoms of an internal strangulated hernia of the part supposed to have been injured, and is likely to die unless relieved, what is to be done? Why, you must make an incision through the wall of his abdomen (as the accoucheurs do in this part of the ladies), just over the suspected spot; introduce your hand through this cut, feel with your forefinger for the hole in the diaphragm, and withdraw the strangulated part, even if it should be necessary to enlarge the hole in the diaphragm by a blunt-pointed bistoury. If it should have formed attachments and cannot be withdrawn, the strangulation may be relieved and the patient survive. It is an operation you should practise every time you open a dead body, and it will be a great triumph for surgery to save the life of even one person labouring under an infirmity otherwise at this moment invariably mortal. It will be my reward for the extra labour I went through in 1811."

He gives full accounts of many other cases, all of great interest, but there is no need to quote further.

Guthrie was the first surgeon to record the fact that wounds of the diaphragm do not heal, and the statement, if qualified by saying the *muscular* part of the diaphragm, is correct, for Greig records a case of a wound of the central tendon which did heal:—

"A lad who, falling on an upturned pitchfork, was pierced through the epigastrium and the central tendon of the diaphragm into the heart wall. The hæmopericardium I relieved by incision from below the central tendon of the diaphragm and then suturing the wound with catgut.

"Seven years later he was admitted to hospital suffering from endocarditis, from which he died. The post-mortem examination revealed 'a wound in the tendon of the diaphragm soundly healed but recognized as a linear cicatrix.'"

It should be recognized, however, that Guthrie was speaking of untreated wounds of the diaphragm and that in Greig's case the healing of the central tendon took place after the wound had been sutured with catgut.

Guthrie was also the first to indicate that a diaphragmatic hernia might be diagnosed, and to outline an operative procedure for its relief, when strangulation was suspected.

In 1896 Stephen Paget, writing on wounds of the diaphragm and diaphragmatic hernia, draws attention to the fact that this condition might exist all through life and give no trouble, but that in the majority of cases life was made a burden by troubles which were supposed to be due to dyspepsia. In most of them the pains and troubles were worse after exertion; in others, a heavy meal gave relief. (This was observed by Petit.)

He notes that out of 300 cases of all kinds, a right diagnosis was made in seven cases only. He gave three signs, above all others, which may help towards it: hollowness in the abdomen, with fullness in the chest; sounds of movement of stomach or intestine inside the chest; and displacement of the heart. The details are given of four cases in which stab wounds had injured the diaphragm with resulting hernia, two in which nothing was done, one of primary operation and one of secondary operation.

He says: "It seems clear that the best way to reach a diaphragmatic hernia is through the pleura, not through the abdomen."

He quotes two successful cases by Postemski; the pleura was opened through the seventh space; in one, Postemski reduced the bowel, in the other he sutured and reduced the stomach; in both he closed the opening in the diaphragm.

Much the same story goes on until the twentieth century when the diagnosis became almost a certainty because of the X-ray examination and more especially from 1905 onwards by means of the bismuth meal. This led to an enormous increase in the number of cases diagnosed during life. In 1912 Scudder stated that over a thousand cases were on record and I estimate that at the present date this number has more than doubled. The literature is so extensive that I can only refer to those cases which illustrate particular points. The clinicians of the older times have graphically recorded all types of diaphragmatic hernia. It is true that these are almost all post-mortem records but they are accurate observations.

Since 1905, X-ray examination has made possible an accurate diagnosis during life and this is assuredly one of the triumphs of radiology, a triumph which has paved the way for the surgeon in his successful treatment of so many cases. I wonder what G. T. Guthrie would have thought of it! Yet withal, there is only one entirely new type of congenital abnormality, associated with the diaphragm, which has been described recently—the thoracic stomach of Bailey (1919), and that was not an X-ray discovery.

A hernia may be defined as "the protrusion of an organ or part of an organ, or other structure through the wall of the cavity normally containing it." The term is qualified by the name of the protruding part, e.g. cerebral hernia, or by the name of the structure or part through which it passes, e.g. diaphragmatic hernia, or yet again, by the name of the cavity which receives it, e.g., scrotal hernia, thoracic hernia.

Anatomical Considerations.

Before proceeding to a classification the following anatomical points may be considered. The diaphragm, the large, powerful musculo-tendinous structure which separates the thorax from the abdomen, is specially suitable for radiological

investigation because of the contrast which its heavy shadow makes with the lighter shadow of the lungs.

It consists of a peripheral muscular structure, which is inserted into a tri-lobed central tendon, the middle portion of which is fixed by reason of the fibrous portion of the pericardium, which is implanted into it, being connected above with the deep cervical fascia.

It is pierced by numerous structures, but the sympathetic trunk and the splanchnic nerves pierce or pass posterior to the diaphragm. There are two special openings, the foramen quadratum, in the right lobe of the central tendon, for the passage of the inferior vena cava, and the œsophageal opening in the muscular substance of the diaphragm, posterior to the central tendon; this opening is surrounded by a sphincter-like arrangement of the crural fibres, and transmits the two vagi nerves as well as the œsophagus.

Furthermore, the design of the diaphragm is such that during inspiration the tendency is for the œsophageal opening to close and the foramen quadratum to open. This tends to prevent regurgitation of food from the stomach and avoids any compression of the vena cava.

It is only in mammals that the diaphragm forms a complete septum between the thorax and the abdomen. The ventral part of the diaphragm is formed from the intermediate part of the septum transversum; the dorsal portion is developed from the mesoderm of the dorsal mesentery of the foregut, whilst the lateral parts are derived from a lateral ingrowth which springs ventrally from the septum transversum and laterally from the body wall. The two lateral portions grow towards the median plane till they fuse with the dorsal portion, but in some cases the fusion is not completed. This is most common on the left side, which is the last to close. In such cases a communication exists between the pleural and peritoneal cavities and a congenital diaphragmatic hernia may result.

In addition, the striated muscle of the diaphragm, according to Barden, takes its origin from a pair of pre-muscle masses, which, in a 9 mm. embryo, lie one on each side, opposite the fifth cervical segment. This is the level at which the phrenic nerve enters the septum transversum. The exact origin of these muscle masses is in doubt, but they probably represent a portion of the cervical myotome of this region. The muscle masses migrate caudally with the septum transversum and develop chiefly in the dorsal portion of the diaphragm; a failure in development, partial or complete, accounts for congenital hernia of the eventration type; these are nearly all on the left side.

The diaphragm receives its nerve supply from the phrenic nerves, which arise mainly from the fourth cervical, with additional branches from the third and fifth. It also receives fibres from the lower thoracic nerves and from the diaphragmatic plexus of the sympathetic. Keith has shown that mammals have retained the cervical innervation of the amphibians, the innervation in all birds, except the ostrich, being from the lower thoracic nerves.

Its normal position varies slightly. In adults, in the erect position, the central tendon is usually about the level of the eleventh dorsal vertebra. The right dome rises to the height of the lower border of the fifth rib, and the left to the upper border of the sixth rib (anteriorly).

At birth the position of the diaphragm is higher, the central tendon being at the level of the eighth to the ninth dorsal vertebrae. It becomes lower when the child begins to walk and gradually reaches the level of the eleventh dorsal vertebra.

The right leaflet, resting on the liver, is visible throughout its whole extent. The left leaflet rests on the stomach, but here the inner part is obscured by the heart shadow, which also obscures the outline of the central tendon. The outline of the diaphragm below the heart becomes apparent during forced inspiration. In the

lying-down position there is a marked diminution in the extent of the movements of the diaphragm. I have also observed that when lying on one side there is a lessened excursion of the leaflet of the diaphragm of that side. Normally the movements of the two leaflets are synchronous.

During inspiration, the powerful downward thrust of the diaphragm on the right side depresses the liver, etc., but on the left side the air-cap of the stomach acts as a buffer taking up the force of the diaphragm movement. During an X-ray examination the stomach can be seen to alter in shape with the action of respiration. During inspiration it becomes shorter and broader, but the lowest part of the greater curvature does not alter in position. This holds good in whatever position the body is placed, although the air in the stomach may not be immediately under the diaphragm. In some of the lower animals—e.g. dog, cat, rabbit—the air-cap does not lie immediately under the diaphragm, but it can be seen to take up the thrust of the diaphragm by its elasticity. The gas forming the air-cap is composed mainly of atmospheric air swallowed in taking food and drink.

The X-ray examination is of supreme importance in the diagnosis of diaphragmatic hernia. Most cases are sent for X-ray examination because of the stomach symptoms, and the bismuth meal rarely fails to furnish conclusive evidence when the condition exists. The number of cases diagnosed apart from the X-ray examination is no greater than it was in the eighteenth century, the great majority of cases being discovered in the X-ray room during routine examination of obscure stomach and chest cases, or in the pathological department, in unsuspected cases.

Cases are missed in the X-ray examination and mistakes are made, but these are due either to a lack of knowledge, or to a lack of thoroughness in examination.

One cannot stress too strongly the necessity of examination in both the upright and the lying-down position; for the latter, a couch with a tilting top is almost a necessity.

Classification.

Diaphragmatic herniæ may be congenital or acquired and may be described as "true" or "false" according to whether or no they have a sac. It must also be remembered that a congenital condition may exist throughout life, inviting a hernia, an invitation which may or may not be accepted.

The following classification is imperfect but is useful for descriptive and teaching purposes.

(1) Gross structural defects. (2) Limited structural defects. (3) Eventrations (so-called). (4) Unilateral phrenic paralysis. (5) Thoracic stomach (Bailey). (6) Through normal openings in the diaphragm. (7) Lacerations of the diaphragm by wounds, accidents or disease. (8) Sudden giving way of a congenitally weak part.

General description.—In about 80% of all cases of diaphragmatic herniæ the herniæ are on the left side. It has always been recognized that the condition was more prevalent on the left side, and Petit suggested that the liver protected the right side. The last part of the diaphragm to fuse is on the left side posteriorly, which may account for the numerous congenital cases in that situation.

The X-ray examination, which is after all only a part, albeit a most important part, of the physical examination, has made the diagnosis in the majority of cases a matter of certainty. An early diagnosis is of great importance, for there is always a danger of a diaphragmatic hernia becoming strangulated and an emergency operation having to be carried out instead of a carefully planned one. Many cases have been suspected in the routine examination of the chest, but they are sometimes missed through lack of thoroughness in the examination. Abnormal shadows in the chest due to a diaphragmatic hernia have been mistaken for pleurisy with effusion, for thickening of the pleura, for a hydro- or pyopneumothorax, or even for an hour-glass stomach.

It is only by the clear demonstration of the presence of abdominal organs in the thoracic cavity that a definite diagnosis can be made. For this an X-ray examination by means of the opaque meal and enema is essential. It is better to carry out a routine examination in the first place, and later on to examine with a special technique if necessary, as in the case of a suspected para-oesophageal hernia. When I use the term "routine examination" I mean a complete examination of the gastrointestinal tract, which should always include examination in the lying-down position. A table with a top which can be tilted is a necessity, for by its use the head can be lowered and the opaque meal made to outline the fundus of the stomach. In one case I was enabled to make the barium food flow through the opening in the diaphragm by this method.

The differential diagnosis is not always easy; it is sometimes exceedingly difficult to distinguish between the so-called eventration of the diaphragm and a hernia of the stomach into the thorax. There is one point which, so far, I have found to hold good. The line of fluid in an eventration is always at the level of the oesophageal opening, whilst in a hernia, where the stomach is in the thorax, the fluid level rises high into the chest, according to the quantity of fluid present.

A hydropneumothorax, a subphrenic abscess and a diaphragmatic hernia of the stomach may present very similar appearances on screen examination and in the radiographs taken, but here the opaque meal and the clinical history give the correct diagnosis. It is not wise—and quite unnecessary—to claim too much for any X-ray examination, and to state, as has been done, that the screen examination of a case of hydropneumothorax presents a pathognomonic picture is mere foolishness.

A special technique is necessary to establish the diagnosis in cases of small para-oesophageal herniæ. The essentials of this examination were first suggested by Soresi, and subsequently elaborated by Healy, L. B. Morrison, and Abbott. The patient is examined in the supine position with the head lowered. A mixture of barium and water is given in small quantities, and its progress through the oesophagus into the stomach is watched. The fundus of the stomach is outlined, and when the patient takes deep breaths, a portion of the fundus can be demonstrated rising up alongside the oesophagus above the level of the diaphragm.

Healy records fifty-three cases. There is no doubt that the para-oesophageal type is of frequent occurrence, and is more often found now that attention has been drawn to it. The diagnosis in many of Healy's cases was confirmed at operation, the condition dealt with surgically, and the patient cured. These patients suffer from vague indefinite gastric symptoms, especially when lying down, and when there is no evidence of a gastric ulcer or a pathological gall-bladder, this condition should be looked for. It has to be differentiated from cardio-oesophageal relaxation, diverticulum of the oesophagus and the congenitally short oesophagus, and it is here that examination by the oesophagoscope is of great value.

In connection with diaphragmatic hernia, it is of interest to note that gastric ulcer has been associated with it in five cases.

Collier, Hurst, and Sheaf record two cases of gastric ulcer associated with congenital diaphragmatic hernia and give references to three others. So far as I know, these are the only cases to be found in the literature.

Group 1. Gross Structural Defects.—Many cases are reported in children, still-born or only living a few hours, and Cruveilhier has reported a case of entire absence of the diaphragm. More frequently there is absence of one-half of the diaphragm and this condition is compatible with life and work. It may be entirely unsuspected as in Case 1 and is inoperable.

In both the cases I have seen, the stomach lay in the abdominal cavity, the duodenum passing upwards to the left thorax where most of the small intestine and part of the colon were housed. The colon does not rotate and the cæcum is high up

in the thorax. Duval has recorded a case of appendicitis occurring under such circumstances.

In Case 2, which was explored, the small intestine was found to be receiving azygos vessels from the thoracic aorta which again rendered it inoperable.

In both cases the scaphoid abdomen was marked, and this is always so when the small intestine passes into the thorax. There is little danger of strangulation in these cases as the opening is so large. In all of them the thoracic and abdominal cavities are in communication, and of course, solid viscera have often been found forming part of the hernia.

A study of the literature shows that in one case or another, every abdominal organ, with the exception of the bladder, rectum and genital organs, has been formed in the thorax.

There is of course no sac in this type.

Group 2. Limited Structural Defects.—Limited structural defects are due to failure to close some of the parts forming the diaphragm, and it is usually the posterior part of the left leaflet where the fault is found. A complete failure to close will result in a congenital hernia, whilst an imperfect closure would mean a congenitally weak place, inviting a hernia throughout life. The pleural and peritoneal cavities may be continuous but, on the other hand, there may be fibrous tissue lined by pleura and peritoneum joining the parts and forming a sac for the hernia. Cruveilhier, Ferriar and Tennant have described cases of this type.

Some of the para-oesophageal herniæ are of course congenital in origin, but I shall speak of them all together.

Keith described 34 museum specimens and in 21 cases out of the 34 the herniæ were on the left side and posterior, being caused by a failure to fuse of the dorsal and lateral portions of the diaphragm during its development.

Group 3. Eventrations (so-called).—It is usual for writers on this subject to begin by stating that "Petit, in 1790, described a diffuse relaxation of the diaphragm," or that "Eventration of the diaphragm has been known ever since J. L. Petit reported and named a case in 1790." This is unfortunate, as Petit died in 1750. I can find no record of his having published any communication on this subject, but his pupil Lesne who worked with him during the last six years of his life, and wrote much to his dictation, collected and published his works in 1774. A second edition was published in 1780 and a third in 1790. The one usually found in libraries is the 1790 edition.

The term "eventration" was never used by Petit in his writings, or by his pupil Lesne in the posthumous works of Petit. It was used by Cruveilhier and by him attributed to Petit in one publication and to Beclard in another. Cruveilhier says, "C'est encore à J. L. Petit que j'emprunterai le type de l'éventration diaphragmatique," but in another and earlier work, commenting on Petit's case he says, "Un cas de hernie thoracique rapporté par J. L. Petit (œuvr. posthum.) doit être, suivant la remarque judicieuse de Beclard, rapporté aux éventrations." Nowhere in Petit's works can I find the term "éventration" and so far I have not been able to trace it to Beclard. There I must leave it for the present, except to say that it is an incorrect term for this condition which I prefer to regard, as Petit did, as a form of diaphragmatic hernia.

Group 4.—Unilateral Phrenic Paralysis.—Radiographically unilateral phrenic paralysis presents similar features to those of diaphragmatic hernia of the eventration type.

Disease or injury may affect either the right or the left phrenic nerve, causing paralysis of the corresponding leaflet of the diaphragm, and all the signs and symptoms recorded under eventration are also found in these cases.

I have found it mainly associated with secondary carcinoma in the chest but have also had cases in which the phrenic nerve was involved in primary cancer.

One case was caused by a lymphadenoma, others were associated with tubercle, and one case with aneurysm.

In all these cases the phrenic nerve was involved close to the root of the lung and it is worthy of note that degeneration of the muscle of the diaphragm takes place very slowly after the phrenic nerve has been completely destroyed. This is well illustrated in a study of the chest in cases of phrenic avulsion or phrenicotomy, the rise of the diaphragm being a gradual process. All these cases eventually present the same features as do cases of eventration and unilateral phrenic paralysis. The probability is that some innervation is still obtained from the intercostal nerves.

Group 5.—Thoracic Stomach.—Bailey, in 1919, described a case of thoracic stomach. He says, "There have been many cases reported of hernias of the stomach into the thorax, but so far as I can find in the literature, no actual case of development of the stomach in the thorax."

The condition was found post mortem in a man who died, aged 77, from arteriosclerosis and interstitial nephritis. Clinically, there was no reason to suspect any abnormality. There was no history of any gastric or cardiac disturbance, and the nurse in charge of the ward stated that the patient's appetite was good to within a short time of his death.

The stomach was in the chest, lying between the pleural cavities and behind the pericardium in the posterior mediastinum. It was completely surrounded by a serous sac, continuous with the peritoneum through the opening in the diaphragm which was 4 cm. in width and at the level of the eleventh thoracic vertebra. The œsophagus was straight and ended at the level of the third costal cartilage.

Bailey concludes as follows: "There is no evidence that the stomach had herniated into the thorax. Its position and relations may be explained by supposing that the anlage of the stomach lay abnormally far anterior on the alimentary canal. The peritoneal pockets around the stomach develop before the descent of the diaphragm and finding the peritoneal relations already developed, the diaphragm would necessarily leave above it, as it descended, not only the stomach, but also the extension of the peritoneal cavity."

In 1924 Le Wald described two cases, along with the X-ray examinations.

(1) Male, aged 7 years. History of accident five years previously. Badly nourished and history of gastric trouble. Stomach entirely above diaphragm, and at operation no defect in the diaphragm found—an interior gastro-enterostomy was performed. There was a short œsophagus.

(2) Female, aged 69 years. History of accident twenty years previously. Epigastric pain and indefinite gastric symptoms. Short œsophagus. Stomach entirely within the chest. No evidence of any other abdominal organs in the chest.

Le Wald attached no importance to the history of accident in his cases, and the illustration of his first case—a drawing—shows the stomach lying in front of the heart. This is impossible in a case of thoracic stomach. He also quotes Bailey's case, but gives the year as 1923. It should be 1919.

Recently, in Liverpool, Dr. Roberts showed me a case which I think is a genuine one of thoracic stomach, and I am indebted to him for the note and lantern slides. [Shown.]

E. W., a girl aged 3 years and 10 months. History of stomach trouble from 12 months. Vomiting—ejects her food. Badly nourished. No pain, but breathing often difficult after food. No history of injury.

X-ray examination: Stomach entirely above the diaphragm, and behind the heart. Pylorus to the right of the middle line. No other abdominal organs in the chest.

A fifth case of thoracic stomach was recorded by Dr. Hugh Morris, of Salford.

Female, aged 44 years. Good health up to one year ago, when she had vague indigestion which had no relation to food. Physical examination of chest and abdomen failed to reveal anything abnormal, but, in view of age and history, a clinical diagnosis of cancer of the stomach was suggested.

X-ray findings: Stomach above diaphragm, mostly on right side and behind the heart. Œsophagus short. Pylorus corresponded with œsophageal opening in diaphragm. Duodenum in abdominal cavity.

Clinton G. Lyons claims to add a sixth case, but a study of the radiograms published and his own statement that

"the ingestion of an opaque meal reveals the barium passing the œsophagus without hesitation and entering the stomach normally. After a few swallows of barium a portion of the meal was seen to shoot upwards and occupy a position in the thoracic cavity. On bending the patient to the left and right the meal formed an 'hour-glass' appearance and fluctuated freely from the abdominal to the thoracic cavity"

clearly proves that this was a case of para-œsophageal hernia and not a true thoracic stomach.

Both Morris and Lyons follow Le Wald and give Bailey's case as in 1923. Bailey's paper was first published in 1919.

Dr. Allan recently brought me radiographs of a true case of thoracic stomach in a child. (For particulars see note in the case records.)

The following case recorded by Rigby and Jones in the *Proceedings of the Anatomical Society* (No. 4), November, 1901, seems to me to have some bearing on this subject.

In a dissecting room subject—a female over 60 years of age—the œsophageal orifice measured 5.6 cm. in diameter. The stage of the œsophagus which is normally within the abdomen was dilated, drawn within the posterior mediastinum, behind the pericardium and covered on its left and anterior aspects by the left pleura. The line demarcating the œsophagus from the gastric mucous membrane lay above the level of the diaphragm, part of the cardiac end of the stomach filling the œsophageal orifice. A circular fold of the peritoneum was also drawn through the orifice with the cardiac part of the stomach.

Later, another case was found in the dissecting room—a female aged 65—showing the same condition, but in a more marked degree, one-third of the cardiac part of the stomach lay above the diaphragm.

Keith regarded the condition as developmental, but the consensus of opinion among the members present was that the condition was pathological and due to a dilatation of the œsophagus.

I think it must be obvious that the thoracic stomach and congenital shortening of the œsophagus are necessarily accompaniments of each other, and now that attention has been drawn to this condition, more cases are being recorded. The congenital shortening of the œsophagus in a minor degree, so that a small portion of the stomach is above the diaphragm, is not at all uncommon, and in Dr. Connell's case, in which an œsophagosopic examination was made, it was clearly demonstrated that the œsophagus was short, and that a portion of the stomach was passing through the œsophageal opening.

Case 37 of my own is another of these cases. It is of importance to differentiate this condition from the small para-œsophageal hernia.

Group 6. Through normal openings in the diaphragm.—The normal openings in the diaphragm which we have to consider are the œsophageal opening and the foramen quadratum, and although herniæ are recorded through openings for the passage of nerves, on investigation one concludes that in these cases the herniæ occur behind the diaphragm through the passage for the sympathetic trunk and splanchnic nerves.

One of the most common of diaphragmatic herniæ is the para-œsophageal. This was originally described by Morgagni. Soresi, in 1919, insists on the frequency of very

small diaphragmatic herniæ, causing obscure abdominal symptoms, and advises the surgeon to examine the diaphragm carefully in all laparotomies. He further says that as yet, X-rays have not demonstrated small diaphragmatic herniæ, but suggests repeated X-ray examination in the lying-down position with the head lowered and during deep inspiration. In these observations Soresi gave the necessary technique for the detection of small para-œsophageal herniæ.

The larger ones can hardly be mistaken, many of them showing, in the upright position, the fluid level with air above. Abbot, in 1924, demonstrated that the small variety was quite common and only demonstrable by the X-ray examination in the recumbent position and then only on deep inspiration.

In 1925 Friedenwald and Feldman reported six cases and Healy in the same year reported fifty-three cases. In Healy's cases the size of the hernia varied from that of a walnut to that of a grape-fruit.

Para-œsophageal herniæ may be congenital in origin or acquired. Congenital ones can of course be classified as "limited structural defects." They arise from a faulty formation of the diaphragm in the œsophageal region.

Broman has shown that in the human embryo, the lesser peritoneal cavity encircling the intestine is constricted by the fusion of the diaphragmatic anlagen. Thus a blind sac is formed between the right wall of the œsophagus and the diaphragm. This quickly disappears in the majority of cases but it may persist between the œsophagus and the diaphragm. Here there may be a weak place inviting a hernia, or, if the structural defect is great, the hernia may be of congenital origin.

Group 7. Laceration of the diaphragm due to wounds, accidents and disease.—In the olden times when the only method of settling disputes between gentlemen was the duel, wounds of the diaphragm were of frequent occurrence.

Wars, at all times, have provided many cases, and the earliest records of diaphragmatic hernia are those made by military surgeons.

Injuries sustained by workmen when great abdominal pressure has occurred, have led to rupture of the diaphragm, and cases are recorded associated with fractured ribs, as in those by Telford.

It has also to be noted that purulent processes above or below the diaphragm may cause destruction and allow of a diaphragmatic hernia; this type is specially noted by Canman and Fineman. Case 48 (J. K.) is I think one of these cases.

Guthrie was the first to note that an injury to the diaphragm never healed. Greig published a case in which an injury to the diaphragm did heal but it should be noted that it was only after operation. Certainly an injury to the muscular portion of the diaphragm never heals, apart from operation. The edges soon become smooth and rounded and a communication exists between the pleural and peritoneal cavities. Apart from the history it is often impossible to say whether such an opening in the diaphragm is of traumatic or congenital origin.

There is yet another point of interest in these cases, for what may have been described by the radiologist as a small opening in the diaphragm, with part of the stomach, or it may be the colon, etc., herniating through into the thorax, becomes a very different condition when the surgeon operates. The moment air is admitted the negative pressure during inspiration pulls up the abdominal organs into the chest. It is a powerful force, and where only a small portion of the stomach was present in the X-ray examination, the whole stomach may be found to ascend into the chest as soon as air enters.

Group 8. Sudden giving way of congenital weak part.—A congenital weak part of the diaphragm may suddenly give way and allow of a large diaphragmatic hernia.

Case 57 to which I referred was of this type and probably many others have occurred.

I will conclude by quoting a case recorded by Astley Cooper.

"Dr. Leacock, while a student at Edinburgh, made the following notes of a case of a diaphragmatic protrusion, which he had the kindness to transmit to me.

"James Morton, a blacksmith, aged 49, was admitted on January 15, 1815, into the Infirmary of Edinburgh, with some pain of the abdomen, particularly of the epigastric region, which was augmented by the slightest pressure or motion of his body. He was affected also with vomiting of whatever was received into the stomach, with rigors, and with a tendency to syncope on the slightest exertion. His countenance expressed much pain; he lay generally on the side with the knees drawn towards the abdomen; his breathing was quick and anxious; pulse 60, very small and weak; tongue clean and dry; thirst excessive; belly reported to be regular; urine had not been passed for some hours; the surface was covered with perspiration.

"The pain of his epigastrium had been of four or five hours' standing. Upon its first coming on he took a glass of whisky, which procured him temporary relief. Vomiting, however, soon supervened, the pain recurred more severe than before, and gradually increased. He could assign no cause for his complaints, except that he had drunk strong ale the night before. Had used no medicine but a dose of salts, which he vomited up. He was bled to 20 oz.; he had ol. ricini 1 oz. given to him, and an enema. At eight o'clock p.m. the pain was but little if at all relieved—it had extended itself over the abdomen. Vomiting had abated; the pulse was rather fuller; thirst still urgent; one scanty alvine evacuation was produced, but little of the injection was received; the bleeding he bore well; it was now repeated; a blister was applied over the whole abdomen; the enema was repeated, and the decoct. avenae used as a drink.

"At twelve o'clock the pain was reported not to be relieved, although he appeared to endure pressure better than before, nor did his countenance express so much pain. He lay with his legs more extended, and he moved about more freely. Vomiting still occasionally recurred; his pulse was 134, fuller and stronger; no alvine evacuation had been procured. When 16 oz. of blood were drawn he had a tendency to faint; the blood was not sisy.

"Venesection was again repeated; the enema also, and a fourth part of the following mixture given every hour: Aq. menthae, ol. ricini, āā. oz. iss.; aq. potassae gt. x. F. Mist.

"On the sixteenth, at eight o'clock a.m., he expired. Sixteen oz. of blood had been drawn, which was not sisy. During the night he became very restless, and a small quantity of dark-coloured matter was passed by stool.

"*Dissection.* (Summary).—The stomach was completely twined round and was seen immensely distended, with the spleen lying on its upper and forepart immediately below the ensiform cartilage and a little to the left side. There was an opening in the left muscular portion of the diaphragm, 2 in. in diameter, near the vertebrae, through which half the pyloric portion of the stomach, part of the colon and omentum protruded into the left thorax."

It is only a little over a hundred years since James Morton died. We smile at the treatment to which he was subjected. I wonder if, in another hundred years, our successors will be similarly moved to laughter by the present-day methods of treatment.

SUMMARY OF CASE RECORDS.

Diaphragmatic hernia	...	...	36 cases
Unilateral phrenic paralysis	...	...	20 cases
Total	...	...	56 cases

Group 1.—Gross Structural Defects.

Case 1.—D. R., male, aged 34. Congenital absence of the left leaflet of the diaphragm.

History: History of ten years' vague stomach symptoms. Dull pain in epigastrium. No sickness. No vomiting. He is a motor mechanic and associated the stomach symptoms with exposure to petrol fumes, as all his stomach symptoms disappeared when he went on holiday in the country.

X-ray Examination: "J"-shaped stomach lying low. No filling defect. Peristalsis active. Pylorus patent. Duodenal cap well formed. Duodenum runs upwards and all the small intestine was found in the left hemithorax. Later on, part of the colon (including the

cæcum) was also found in the thorax. The colon lay entirely to the left side of the spine. There was absence of the left leaflet of the diaphragm, almost certainly of congenital origin.

Case 2.—C. S., male, aged 11. A case in every way similar to the above. The stomach was in the abdomen; the bulk of the small intestine, the cæcum and part of the colon were in the left hemithorax. An exploratory operation by the thoracic route was performed, but the small intestine was receiving azygos vessels from the thoracic aorta, which made it impossible to do anything.

Group 2.—Limited Structural Defects.

Case 3.—P. F., male, aged 44. History of vague stomach symptoms for over twenty-eight years.

X-ray examination: Showed a limited structural defect in the posterior part of the left leaflet of the diaphragm through which part of the stomach had passed into the chest.

Group 3.—Eventrations (so-called).

I published records of six cases in 1923, under the title "Elevation of the Diaphragm." Since then I have seen six more cases. These present no new feature. (See Bibliography.)

Group 4.—Unilateral Phrenic Paralysis.

In the same paper I discussed unilateral phrenic paralysis and recorded nine cases. One frequently finds this condition if it is sought for, more especially in secondary malignant disease, and I have records of eleven more cases. (See Bibliography.)

Group 5.—Thoracic, Stomach and Congenital Short Œsophagus.

Case 37.—C. E., female, aged 60.

History: This patient gave a history of twelve years' difficulty in swallowing which during the last six months had been gradually getting worse. A year previously she had been treated for stricture of the œsophagus by bougies and improved. She frequently vomited immediately after food, which gave her relief, and stated that about two years previously she vomited a large bowlful of clotted blood. Her appetite was poor and she had been losing weight.

X-ray examination: Showed stricture of the œsophagus, with rounded end about 3 in. above the diaphragm. She continued to vomit black material every day. Sometimes, however, she vomited bright red blood. Motions were red and tarry. She became badly jaundiced and gradually became worse. She died three days after admission.

Post-mortem: There was a congenitally short œsophagus, $2\frac{1}{2}$ in. of the stomach being above the diaphragm. At the lower end of the œsophagus was a peptic ulcer. The gall-bladder was enlarged with concretions in it and a carcinoma of the ampulla of Vater was found.

Case 38.—(Dr. Allan's case.) A baby, aged 8 months. Much under weight. The X-ray examination showed the stomach to be in the thorax, situated behind the heart; the pyloric end of the stomach passed through an opening in the diaphragm, which was more central in situation than usual.

Case 39.—Mrs. B., female, aged ?

History of indefinite stomach symptoms for some years.

X-ray examination: Dr. Connell, of Carlisle, found a congenital short œsophagus, and this was confirmed by examination with the œsophagoscope. About $1\frac{1}{2}$ in. of the stomach lay in the chest above the diaphragm.

Group 6.—Through Normal Openings in the Diaphragm, e.g., Œsophageal.

Case 40.—Mrs. N., female, aged 65.

History of indigestion for many years. An X-ray examination had been made and a diagnosis of hour-glass stomach come to. At operation the surgeon could not find any hour-glass stomach. He noted that the œsophageal orifice was dilated, easily admitting three fingers. An X-ray examination fourteen days after the operation, showed that what had been taken for an hour-glass stomach was a para-œsophageal hernia.

Case 41.—D. S., male, aged 19.

History: Vague stomach symptoms for many years. Patient looked ill and was not well-nourished.

X-ray examination showed a large para-*æ*sophageal hernia which was subsequently successfully operated on by Professor Wilkie. The patient has put on weight and looks well, and—two years later—the diaphragm remains intact.

Case 42.—Mrs. W., female, aged 40.

History of dyspepsia for some years and lately some difficulty in swallowing.

X-ray examination revealed a small para-*æ*sophageal hernia.

Note: Mrs. W. has complained for some years of dyspeptic symptoms. Improvement from time to time, with treatment. The condition was attributed to "nerves." Recently there has been some occasional difficulty in swallowing. Gastric analysis normal.

X-ray examination requested so as to exclude any organic lesion.

Case 43.—J. W., female, aged 70.

History: Had been troubled intermittently with indigestion since she was a young woman. Burning feeling in epigastrium. Flatulence, vomiting and sickness at first but not now. During the last eighteen months had lost some weight and has a feeling of discomfort after taking food. Occasional stinging pain in epigastrium but this did not last.

X-ray examination showed a small para-*æ*sophageal hernia with a gas bubble in the herniated portion.

Case 44.—A. McL., female, aged 68. This patient died from tuberculous infection of both kidneys and post-mortem a para-*æ*sophageal hernia was found of which there was no suspicion during life.

Case 45.—A. S., male, aged 44.

X-ray examination (June 21, 1925): Part of the stomach had herniated through the *æ*sophageal opening and was lying above the diaphragm mostly on the right side above and behind the liver. Marked deformity of the stomach. At different examinations varying degrees of this hernia were seen. In the lateral view it was seen lying behind the heart. There was no history of injury. Mr. Morley operated and found a hernia of the stomach, with a sac, through the *æ*sophageal opening. The opening was closed and the patient made an uninterrupted recovery.

Case 46.—W. J., male, aged 78.

History of stomach trouble more or less for 30 years, but with intervals of comparatively good health. Complained of pain, after food, at the lower end of the sternum and general discomfort. Had had no difficulty in swallowing until lately when he had slight trouble in swallowing solids.

X-ray examination showed a typical hernia of the cardiac portion of the fundus of the stomach through the *æ*sophageal opening. It varied in size. No pathological lesion was detected in the stomach or duodenum. Air was present in the herniated portion.

Group 7.—Lacerations of Diaphragm due to Wounds and Accidents.

Case 47.—W. C., male, aged 46.

X-ray Examination: Stomach, splenic flexure and colon in thorax. The *æ*sophagus turned abruptly at the level of the 11th dorsal vertebra, and heart was displaced to right. No evidence of gastric ulcer or growth. Stomach deformed. Gunshot wound and empyema.

Case 48.—J. K., male, aged 16.

Admitted to hospital November 15, 1927.

History of appendicitis May, 1926, and operation. Relapse with peritonitis. No further operation. An encysted empyema on the left side was suspected.

X-ray examination showed the presence of the stomach in the thoracic cavity. There was marked deformity of the stomach. The *æ*sophagus entered at the junction of the upper and middle third of the stomach which appeared to fill from below. The pyloric end could not be clearly defined. The colon was also present to the outer side of the stomach.

Note.—The question arises: Is this an eventration or a hernia? Examination of the films shows the line of fluid much above that of the cardiac orifice. I think this is a case of diaphragmatic hernia and suggest that it is associated with the previous illness.

Case 49.—S. B., male, aged 70. (Pathological specimen.)

Admitted to hospital unconscious, November 3, 1928, and died November 4, without having regained consciousness. It is stated that he fell on his head from a height of 20 ft.

Post-mortem there was found a fracture of the skull, with laceration of the brain, commencing pneumonia of the lung, rupture of the right leaflet of the diaphragm with

protrusion of the liver into the pleural cavity which contained a considerable quantity of blood.

Case 50.—J. S., male, aged 40.

History: This was a definite case of hernia through the left leaflet of the diaphragm, due to a gunshot wound.

The X-ray examination of the chest showed an irregular line on the left side, the inner portion of this irregular line being diaphragm—the outer part stomach. The movements were plainly seen on the screen, and one could see the inner half moving downwards while the outer half moved upwards. The bismuth meal examination very definitely established the diagnosis, for with the patient lying down, one was able to run the bismuth backwards and forwards through the opening in the diaphragm and watch the herniated portion of the stomach filling and emptying. This was done by tilting the table top during the examination. The approximate size and position of the tear in the diaphragm were ascertained, and it is interesting to note that the colon was not seen forming part of the hernia during the X-ray examination.

At operation by Mr. A. H. Burgess, of Manchester, the abdomen was opened, and it was found that the outer and posterior part of the diaphragm had been torn from its attachments. Both the stomach and colon formed part of the hernia.

The diaphragm was repaired, and two years later an X-ray examination showed the diaphragm to be intact.

Case 51.—T. B., male, aged 30.

History: Hernia of the right side of the diaphragm due to a gunshot wound in France, in 1914. The right side of the diaphragm was fixed, but the liver shadow was seen to be elevated—reversed movements were observed on screen examination.

Case 52.—J. T., male, aged 60.

History: Fracture of ribs, left side, and clinically diaphragmatic hernia. Stomach and part of colon high up in chest, reaching to level of 3rd costal cartilage. Fractured rib shown. The fluid level in the stomach was seen above the level of the cardiac orifice. Practically the whole of the stomach is in the thoracic cavity.

Case 53.—J. H., male, aged 40.

History: A war injury involving the diaphragm on the left side. Stomach and colon in left thoracic cavity, rising as high as the level of the first rib.

Case 54.—S. B., male, aged 31.

History: A hernia of the splenic flexure through the lower ribs and diaphragmatic attachments, due to a war injury. The thorax shut off from the abdomen. During inspiration the hernia bulges out; during expiration it returns well inside the ribs. This was the reverse of what I expected, and is accounted for by the elevation of the ribs during inspiration.

Case 55.—W. B., male, aged 45.

History: War injury. Sustained shrapnel wounds to left loin, kidneys and ribs in 1915. There was coughing and spitting of blood for some time after the injury, but none for two years previous to the examination (1925). He complains at present of pain in the left ribs and shortness of breath.

X-ray examination showed a large hernia of the splenic flexure through the posterior half of the left leaflet of the diaphragm. At the time of examination the colon alone was seen in the chest.

Case 56.—J. G., male, aged 63.

Three years ago had accident while lifting heavy girder. Since then had stomach trouble. Admitted for gastric symptoms.

X-ray examination: Hernia of stomach through posterior part of left leaflet of diaphragm.

Group 8.—Sudden Giving Way of Congenital Weak Parts.

Case 57.—H. D., male, aged 26.

History: There was no history of any injury. The physical examination gave all the signs of a hydropneumothorax. The screen examination showed the dark line of fluid extending right across the left side of the chest with a clear air-space above it—the air-space extending to the height of the second rib in front, the fluid to that of the fourth. A portion of collapsed lung was noted through this clear air-space. No lung tissue was seen apart from the collapsed lung. There was no definite bow-line observed and no paradoxical respiratory movements. Palpation of the abdomen produced ripples on the surface of the

fluid. The appearances were quite typical of hydropneumothorax. At a later examination, however, the splenic flexure was seen rising up alongside the fluid and slightly above it. At operation it was found that there was a large rent in the posterior wall of the diaphragm, and that practically the whole of the stomach and a large portion of the colon were in the chest.

BIBLIOGRAPHY.

- PARÉ, Ambroise, "Œuvres complètes d'Ambroise Paré," par J. F. Malgaigne, 1840, ii, 95. PETIT, J. L., "Traité de Maladies Chirurg." 1st Ed., 1774; id. 2nd Ed., 1780; id. 3rd Ed., 1790, ii, 234. "Posthumous works collected and edited by Lesne." HILDANUS, "Opera Gulielmi Hildani," Frankfurt, 1646; sen. 2; obs. 33, 108. "Record of a case due to a stab wound." RIVIERIUS, *Opera medica Universa*, London, 1698; ossent quart ob. 67. "Case of congenital hernia of the diaphragm." BECKER, "Acta Erudita Lipsie," 1706, 17. BECKER, T., *Fortschr. a. d. Geb. d. Röntgenstr.*, xvii, 1911, 183. ST. ANDRÉ, M., *Phil. Trans.*, 1717, xxx, 351 (quoted by Campbell). LEPROTTI (quoted by Morgagni). DE VICO D'AZYR, from *Mém. Acad. Roy. des Sc.*, 1772, 2nd part. FERRIAR, J., "Medical Histories and Recollections," 1st Ed., 1792, 41-44. KIRSCHBAUM, Dissertation, Chirurgie, Lausanne, 1755, iii, 217, record of 17 cases. MORGAGNI, "Seats and Causes of Diseases," Letter 54, Monograph on hernia of the diaphragm, 1769. COOPER, SIR ASTLEY, "Anatomical and surgical treatment of abdominal hernia," 2nd Ed., 1827, part ii, 68. CRUVEILHIER, J., "Anatomie Pathologique du Corps Humain," tome Ier, 1829. "Maladies des Intestins," xvii, Livraison, Pl. v; id. "Traité d'Anatomie Pathologique Générale," tome Ier, 1849, 614-617. BOWDITCH, H. I., "Treatise on diaphragmatic hernia," Buffalo, 1853. BALFOUR, T. A. G., *Edin. Med. Journ.*, 1868-69, xiv, 883. LACHER, L., *Deutsch. Arch. f. klin. Med.*, 1880-81, xxvii, 268. GUTHRIE, G. J., "Commentaries on the Surgery of the War in Portugal, etc.," 5th Ed., 1853. GREIG, D. M., *Edin. Med. Journ.*, 1919, xxii, 357; id. *Internat. Clinics*, 1912, iv, 183. PAGET, STEPHEN, "The Surgery of the Chest," 1896. PAGET, SIR JAMES, "Studies of old case books," 1891, 149. ABBOTT, F. C., *Trans. Path. Soc. Lond.*, 1898, xlix, 67. ABBOTT, D. P., *Journ. Amer. Med. Assoc.*, 1924, lxxxiii, 1898. FRIEDENWALD, J., and FELDMAN, M., *Amer. Journ. Med. Sci.*, 1925, clxx, 263. DUVAL, M. P., *Bull. et Mém. Soc. de Chir. de Paris*, 1913, xxxix, 1512. LEECH, E. V., and REDMOND, C. H. S., *Manchester Med. Chron.*, 1909-10, No. 295. TELFORD, E. D., *Manchester Med. Chron.*, 1909-10, No. 295. MORRISON, L. B., *Journ. Amer. Med. Assoc.*, 1925, lxxxiv, 161. TENNANT, J., *Edin. Med. Journ.*, 1894-95, xl, 29. MORISON, J. M. W., *Arch. Radiol. and Electrotherap.*, 1923, xxvii, 602; id. *Acta Radiol.*, 1926, vii, 214. GRIFFIN, H. Z., *Ann. Surg.*, 1912, lv, 388. SCUDDER, C. L., *Trans. Amer. Surg. Assoc.*, 1912, xxx, 428; id. *Surg., Gyn. and Obstet.*, 1912, xv, 261. BAILEY, P., *Anat. Rec.*, 1919, xvii, 107-109. HEALEY, T. R., *Amer. Journ. Roentgenology*, 1925, xiii, 266. COLLIER, W., and HURST, A. F., and SHEAF, E. W., *Guy's Hosp. Rep.*, 1929, lxxix, 159. KEITH, SIR A., "Human Embryology and Morphology," p. 257; id. *Brit. Med. Journ.*, 1910, (ii), 1297. KEITH, D. Y., *Amer. Journ. Roentgenology*, 1920, vii, 289. HOLT, SIR C., *Phil. Trans.*, 1701, xxii. LE WALD, L. T., *Radiology*, 1924, iii, 91. ROBERTS, R. E., *Brit. Journ. Radiol.*, 1927, xxxii, 17. MORRIS, H., *Radiology*, 1929, xiii, 265. LYONS, C. G., *Amer. Journ. Roentgenology*, 1930, xxiii, 67. SORESI, A. L., *Ann. Surg.*, 1919, lxi, 254. CARMAN, R. D., and FINEMAN, S., *Radiology*, 1924, 26. HOFFMAN, V., *Münch. med. Woch.*, 1920, lxxvii, 986. BRIGHT, R., *Guy's Hosp. Rep.*, 1836, i, 598. KEY, E., *Deutsche Ztschr. f. Chir.*, 1924, li, 95. RUGBY, Mr., and JONES, F. W., *Anat. Soc. (No. 4)*, Nov., 1901. *Journ. Anat. and Physiol.*, 1902, vol. 36, p. xxxviii. WILLIAMSON, "Military Surgery," 1663. BAKER, W. M., *Trans. Path. Soc.*, 1877, xxviii, 58. ELWARD, J. F., and OTTELL, L. S., *Amer. Journ. Roentgenology*, 1929, xxii, 535. BOYLE, A., *Edin. Med. and Surg. Journ.*, 1812, viii, 42. MACFADDYEN, J., *Edin. Med. and Surg. Journ.*, 1823, xix, 832. CAMPBELL, W., *Edin. Med. and Surg. Journ.*, 1821, xvii, 513. REID, J., *Edin. Med. and Surg. Journ.*, 1840, liii, 104.

Discussion.—Dr. LEOPOLD MANDEL said that he was particularly interested in Dr. Woodburn Morison's paper, as at the present time he had under his care a child, aged 6, with eventration of the diaphragm. The child had been brought to hospital, having had a cold and cough for ten days. On examination, there was a dull note on percussion at the left base; fluid was suspected and an exploration was carried out, but with a negative result.

Next day, an X-ray examination was made and disclosed the typical condition described by Dr. Morison. There was a complete regular dome on the left side, rising up to the third rib in front. At the bottom of this space there was a sharply defined horizontal line of fluid; on palpation this fluid showed waves and ripples. The bow line plainly showed reversed movement during respiration: upwards during inspiration and downwards during expiration. The heart was slightly displaced.

A bismuth meal clearly indicated the "cup-and-spill" condition of the stomach. The child was perfectly healthy and did not complain of indigestion. An interesting clinical feature was the variation in the percussion note at the left base which could be altered by the patient's changing his position and which varied according to the time of examination in relation to meal-time.

Mr. T. P. DUNHILL: My experiences of this condition are limited to types which I believe to be congenital and which have not caused trouble until after middle age. Mr. J. B. Hume, following Sir Arthur Keith and other writers, has shown that these are chiefly of four types. I have had to do with three of the kind in which the hernial protrusion was through the

left leaf of the diaphragm, and one in which the protrusion was through the œsophageal opening. One of these was discovered by Dr. E. Chittenden Bridges and Dr. Lindsay Locke. A second was discovered by me at operation. Another, preceding these, was, I regret to say, not discovered at operation, although there were appearances present which so troubled me at the time that I noted them all in my records of the case, and if I had been dealing with this patient subsequent to the first case of diaphragmatic hernia upon which I operated, I should have recognized it at once. This patient was sent to me on account of gall-stones, which seemed to be a sufficient explanation of the pain. As is usual, I made a thorough examination of the abdominal contents and noted a constriction in the middle of the stomach for which I could not account, but which did not lead to a diagnosis of the diaphragmatic hernia which was present. The fourth case was diagnosed before operation by Dr. Langdon Brown and Dr. Salmond.

The signs and symptoms have varied a little. One patient suffered from hæmatemesis associated with severe pain, and an X-ray examination was made to determine whether a gastric ulcer was present. In two other cases severe pain of a bursting nature was present immediately after taking food. In the fourth—the case in which the hernia was para-œsophageal—vomiting occurred immediately food was taken, accompanied by pain, but in this case the patient's chief complaint was of uncontrollable vomiting. In none of these cases had there been symptoms in early life, or indeed until after middle age. In each the symptoms, when they began, were progressive, increasing in severity until they were scarcely bearable. The symptoms, although differing in different patients, are fairly characteristic and should determine an X-ray examination. Some part of this should be carried out with the patient in the horizontal position, because the condition may be missed if the patient is examined in a vertical position. Operation was carried through without any great difficulty. The three patients who were operated upon are completely cured of their symptoms. It is six years since the first patient was operated upon.

Mr. GORDON-TAYLOR said he had met with three cases of diaphragmatic hernia. One was a strangulation in connection with a diaphragmatic hernia consequent upon an abdomino-thoracic wound caused by rifle fire; the patient was *in extremis* when operated upon and died almost immediately afterwards.

The second case was that of a medical man who had an abdomino-thoracic wound caused by fragment of high explosive in 1917. Crippling indigestion, which interfered with his work, brought him to seek surgical aid, and he was operated upon on the tenth anniversary of his wounding. The operation was remarkable for the lighting-up of the old war infection of ten years previously, and an infected hemothorax retarded his convalescence for some time. Nevertheless, two years after the operation he had put on nearly four stone in weight and could score eighty-seven runs in one innings at cricket.

The third case, which had at first been regarded as one of a hiatus hernia, proved to be a case of "thoracic stomach." The patient had increasing indigestion of the "bursting" character, to which Mr. Dunhill had alluded. In the second and third cases, operation was performed by the transthoracic route, and in the third case the saccular thoracic stomach was converted into a tube by a plastic operation with a successful result.

Dr. M. WEINBREN said that within the last month he had seen four cases, which illustrated some of the types described by Dr. Woodburn Morison. The first slides seen were from those just mentioned by Mr. Gordon-Taylor. Before the barium was given, an unusual shadow could be detected behind—and projecting beyond—the right border of the heart. On ingestion, the œsophagus was seen to end at the level of the eighth dorsal vertebra. About half the stomach was above the level of the diaphragm. The patient was examined in various positions, but the œsophagus definitely opened into the thoracic portion of the stomach and did not descend below the eighth dorsal vertebra.

The second case was that of a woman, aged about 40, who had been sent for a routine barium meal, the clinical diagnosis being gastric ulcer. It was a case of para-œsophageal hernia. The slide taken with the patient in the erect oblique position illustrated how easily the condition might be overlooked when the hernia was small and if the patient were not examined in the supine position in which the characteristic appearance was obtained.

In the third case, the patient was a male, also aged about 40. Clinically, duodenal ulcer was suspected. The X-ray appearances were very similar to those of the previous case.

The fourth case was of the traumatic type, and he (Dr. Weinbren) had only screened the patient that morning. This man had been wounded through the left chest and there was a

history of empyema following the wound. Some years ago an attempt had been made to repair the diaphragm; he understood from the patient that two holes had been found in it. The colon had passed up into the thorax through one tear and the stomach through the other. The surgeon had brought the colon down into the abdomen and repaired the first tear, but nothing further could be done as the stomach was found to be adherent to the lung. On screening that morning a portion of the stomach and colon had been seen in the thorax. The colon had apparently forced its way up again through the space previously reserved for the stomach.

